ELECTRICAL REVIEW

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VIEWS, NEWS AND INTERVIEWS.

The secretary of the Institution of Electrical Engineers, London, states that arrangements have been made with the British Patent Office, under which there will be placed on the library table at the institution every Monday morning a copy of each electrical patent specification published during the preceding week. The specifications will remain on the table for three weeks, and will then be filed.

It is stated that American electrical manufacturers will exhibit machinery valued at $1,000,000 at the Paris Exposition in 1900.

A lady writes from Constantinople to say that the reason for the backwardness of matters electrical there is that the Sultan can not discriminate between dynamo and dynamite, the second of which he can not endure. It is true, says London *Lightning*, he owns and runs an autocart, but then is he not an autocrat?

An application was made last week to Chancellor McGill, in Jersey City, N. J., for an order to sell the property of the Hudson Tunnel Railway Company, consisting of the unfinished Hudson River tunnel. The application was made in view of the foreclosure proceedings on a mortgage for nearly $4,000,000, held by a trust company. The work of constructing the tunnel has dragged along for many years. The management has changed hands a number of times, the work has been suspended for intervals of a year or two, and the project has met with apparently insurmountable obstacles. If Chancellor McGill authorizes the sale, it is proposed to reorganize the company and push the tunnel to completion. It is said that only 250 feet remains to be finished. The tunnel is designed to extend from Fifteenth street, Jersey City, to Morton street, New York city. It is understood that the new scheme includes a trolley line to be operated in the tunnel, which will carry passengers between the cities in three minutes.

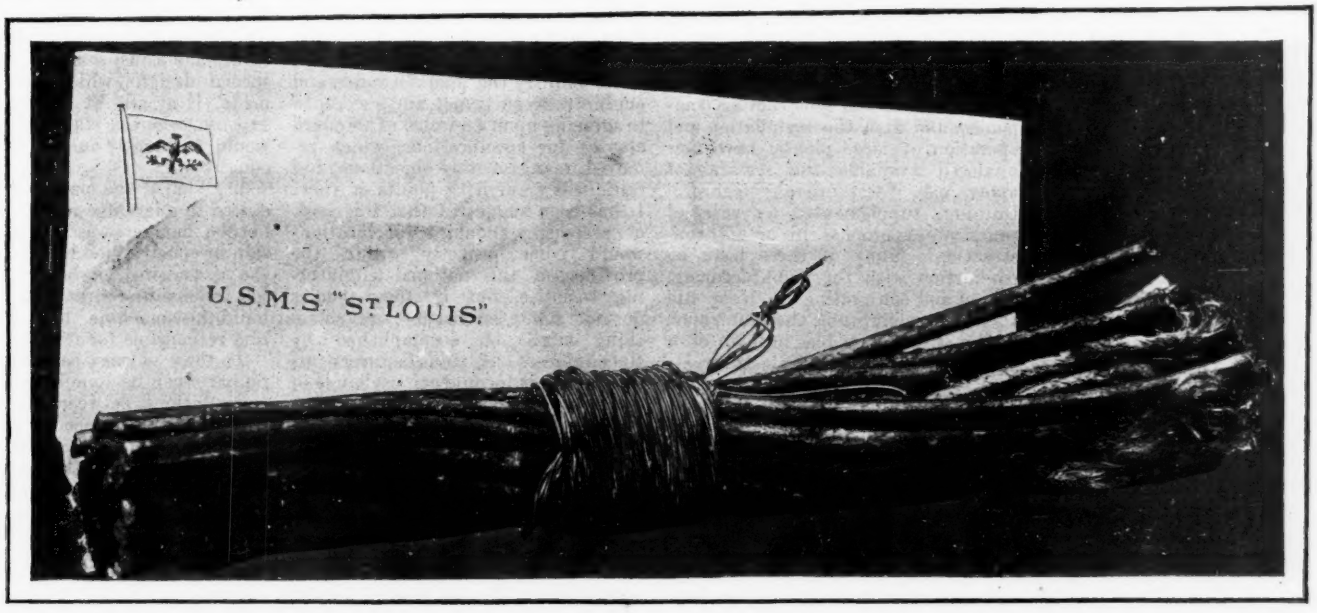
A prominent firm of wire manufacturers recently closed a contract for $50,000 worth of trolley and feed wire and rail bonds, to go to Japan for use on one of the newly projected street railways. This is the second Japanese contract of the same nature and of approximately the same size received by this house within a short time, and it is said that several more contracts for similar material have recently been awarded to other American manufacturers.

The strains to which telephone wires are subjected, when they are weighted with snow or ice, may be gathered, says an exchange, from the fact that in Switzerland, even after an ordinary snowfall, or during frost, the snow or ice deposit on a telephone wire, two millimetres in diameter, often reaches a thickness of 30 millimetres, or 15 times that of the wire. In a recent fall of snow at Zurich it was observed that the snow deposit on telephone wires had a diameter of no less than 60 millimetres, or 30 times that of the wire. Taking the specific gravity of the moist snow deposit at one-fifth of the volume, a span of 100 metres would thus have a snow weight of 60 kilogrammes, or more than 20 times the weight of the wire. Many of the telephone posts at Zurich support iron frames, carrying as many as 250 wires. The snow weight on these, therefore, in a span of 100 metres, would be 15 tons, or 20 times more than the weight in copper.

CUTTING THE SANTIAGO CABLES.

HEROIC EXPLOITS OF OUR NAVY.

Not the least among the many acts of bravery performed by our navy during the present war have been numerous cable-cutting exploits, accomplished with a dash and heroism which have called forth the highest praise. Before the fall of Santiago it was of the first importance to the success of future military operations that cable communication with the city should be destroyed. The following account, from a correspondent of the New York *Herald*, tells how three of the cables were cut:



A BIT OF THE SANTIAGO CABLE CUT BY THE AUXILIARY CRUISER "ST. LOUIS" AND OTHER WAR VESSELS.

"On June 8 the 'St. Louis,' 'Marblehead' and 'Yankee,' with two gunboats, shelled the fortifications of Caimanera, on the Bay of Guantanamo. The fire was most effective. The gunboats, however, paid little attention to the Spanish forts, directing their efforts to cutting the cables which run out of Caimanera. Three cables were cut under the direction of the larger vessels of the fleet. While the 'Marblehead,' 'St. Louis' and 'Yankee' formed in battle order before the forts and opened fire, the little gunboats darted out from the

line and began to grapple for the cable. All the men on the war ships worked with enthusiasm, the New York Naval Reserves on board the 'Yankee' earning their share of laurels at the guns. The bombardment continued until the gunboats cutting the cables had concluded their labors.

"As the walls of the fortifications began to tumble in upon them, the Spanish gunners deserted their post of duty and ran to the town. After firing upon the forts the fleet concentrated its fire upon the block-house, at which the cables of the French Cable and Telegraph Company land, and completely demolished it. The cables which connect the block-house with Caimanera were cut. On account of the cutting of the cable to Santiago, telegraphic communication with that place was suspended. After the fight the 'Marblehead' and 'Yankee' returned to the blockading squadron."

Since the capture of Santiago by our forces, cable communication has been re-established by Lieut.-Col. James Allen, of the signal corps. The Cuban station is at Playa del Este, near Santiago.

The illustration herewith, which is published through the courtesy of *Collier's Weekly*, shows a piece of one of the Santiago cables.

THE RELATIONS BETWEEN THE PURCHASER, THE ENGINEER AND THE MANUFACTURER.

READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS, NIAGARA FALLS, N. Y., JUNE, 1898.

BY WILLIAM H. BRYAN.

When an engineering structure of magnitude is to be erected, what general plan of procedure should be followed in order to insure that the finished work shall be best adapted for the intended purpose, and shall involve the minimum investment of capital consistent with proper construction, and the minimum cost of operation and maintenance?

In the erection of buildings, the precedent of placing the work in the hands of a skilled architect has long since become well established. In civil engineering, the construction of railways, bridges and roofs is universally intrusted to engineers. In the newer branches of mechanical and electrical engineering, however, it has only recently become the practice in this country to engage consulting engineers. The principal reason for this has been that there have been heretofore but few specialists who have devoted their attention exclusively to this class of work. The few well trained men in these fields early connected themselves with manufacturing or contracting companies, or entered into these branches of work on their own responsibility. The natural disinclination of the purchaser to ask for expert advice from an engineer—however competent and experienced—who is known to be interested in the manufacture or sale of some specialty, and whose opinion is not unnaturally open to the suspicion of bias, left him no course but to proceed on his own responsibility, with results which were often as unsatisfactory to the manufacturer as to himself.

This situation has, however, in a large degree changed, owing to the large number of excellent engineering schools, and the very thorough courses of theoretical and practical training which are there given. These, coupled with the large number of trained and experienced men who have been connected with prominent manufacturing and constructing companies, and with the installation and operation of large plants, have now rendered available the services of many men of thorough technical training, supplemented by years of practical experience in actual construction. Many of these have no connection with the manufacturing, selling and contracting interests, and their judgment is not, therefore, open to the suspicion of bias in favor of or against any special manufacturer.

It is becoming more and more the custom, therefore, to place the same confidence in the consulting mechanical and electrical engineer which has long been reposed in the architect and civil engineer. He is called in at the earliest stages of the development of the enterprise for advice as to the general outline and arrangement of the scheme, its probable cost, the expense of operation and maintenance, and the returns which may be expected from the investment. He makes a preliminary reconnaissance and report, giving these data. If these are approved, he then makes a more detailed study of the problem, mapping out the general scheme more definitely, selecting the particular system or type of apparatus best suited to the local conditions of service, and preparing general plans and specifications. These he accompanies with more detailed estimates of cost. When these are approved by his principals, proposals are asked for, and, when received, the engineer assists the purchaser in canvassing and comparing them, and in selecting that proposal—not necessarily the lowest—which seems best to meet the requirements of the work in hand.

The engineer then assists his clients in drawing up the final contracts, supervises the work during construction, and makes such final inspections and tests at completion as are necessary to determine whether the specifications have been complied with.

This has long been the accepted custom in England, where the same difficulty of securing competent and unbiased engineers has not been encountered. No trouble has been met with in that country in applying the same rules to these branches of engineering which are universally followed in other fields.

As might be expected in any new department of engineering, however, the relations between the purchaser, the engineer and contractor have not always been harmonious. The manufacturer frequently feels that he has been imposed upon; the engineer is often hampered by incompetent or unscrupulous contractors, and, between the two, the purchaser himself is sometimes at a loss for a proper solution of the difficulty. While it is true that most contracts of this character are carried through satisfactorily, it must be admitted that misunderstandings are more frequent than they should be.

The discussion of these differences has recently taken tangible form, both in this country and England. In the latter country the manufacturers and engineers recently met, and succeeded in agreeing upon a number of standard clauses for specifications, which removed many of the objections and criticisms from both points of view. It has been suggested that this work of preparing standard specifications would come properly within the province of the national engineering societies, but if these bodies do not take the matter up, something might be accomplished by the engineers and manufacturers getting together for mutual exchange of views, as was done in England.

The present misunderstandings may be traced to a few serious causes: In the first place, the mechanical and electrical fields of work have, unfortunately, been embarrassed by too great a number of incompetent and inexperienced manufacturers and contractors, poorly equipped for good work, and with but limited intelligence and skill. To these have been added a more than ordinarily large percentage of contractors, who are not altogether scrupulous as to their methods, and whose object is to finish the work in almost any sort of shape which will pass muster. These incompetent, inexperienced and unscrupulous contractors—though relatively few in number—have detracted from the good reputation of work of this character, and have forced upon the consulting engineer the necessity of inserting in his specifications the most rigid requirements as to the character of workmanship and material, inspections and tests, which would be unnecessary if it were certain that the work would be awarded to contractors of established reputation, ability and skill.

Furthermore, it has been found that some manufacturers are slow to adapt their designs and patterns to advanced and improved practice. Experience having shown the clear and decided superiority of certain designs, the engineer is justified in embodying them in his specifications, in spite of the fact that some manufacturers will attempt to force the continued use of antiquated forms.

Again, the manufacturers are often careless in making guarantees. Some of them do not hesitate to meet any desired figures if a competitor does so. Often they will oblige themselves to do what is impossible with the type of machinery they offer, and trust to luck or careless inspection or testing to get the work accepted and paid for.

The grievances of the manufacturers have recently taken shape in papers and discussions in the electrical press, and may be briefly summarized as follows:

1. That the engineer appears unwilling to receive suggestions or advice from the manufacturers, as such action might detract from the "dignity" of his position, and that specifications, therefore, often contain many annoying and expensive provisions sometimes impossible of fulfillment.

2. That the engineer does not always familiarize himself with the facilities and standards of the manufacturer, and thus sometimes calls for special designs which can only be made, if at all, at greatly increased expense, whereas standard apparatus would frequently answer the purpose equally well.

3. That if the manufacturer is required to guarantee results, he should not be hampered as to details of design or construction. In other words, the consulting engineer should not tell the manufacturer how he should build his machine, but simply hold him responsible for results.

To these it may be answered that no harm can be done by full and free consultations between the manufacturer and the engineer. They have a common object in view; namely, the securing of the best results. It is natural that the engineer should reserve unto himself a due degree of dignity, but he should not let this characteristic stand in the way of the best service in the interest of his clients.

The demand for special machinery, however, presents greater difficulties. It should be remembered that electrical developments have been so rapid in recent years—and with them the construction of special steam engines and appliances—that a large percentage of the work has necessarily been special. Furthermore, this condition must continue, for the reason that the methods of generating and distributing electricity on a large scale, over wide areas, for endless varieties of purposes, have by no means reached uniformity of practice or system, and are not likely to very soon. The necessity for special machinery will, therefore, remain with us indefinitely, and will continue to cover a large percentage of our work. We must not lose sight of the fact that to attempt to carry the idea of standards too far, will surely result in hindering improvements and stifling progress.

(To be concluded.)

ROENTGEN LIGHT NOTES.

BY WILLIAM ROLLINS.

NO. XXX—THE WAVE LENGTH DEPENDS ON THE TEMPERATURE.

In Note XVIII I stated that the wave length depended upon the velocity of impact. In this note temperature is considered. Fig. 30 shows a modification of the tube described and figured in the ELECTRICAL REVIEW for December 1, 1897. There is a receptacle for a thermometer to show the temperature of the water escaping from the hollow target. If we keep this water at five degrees centigrade a higher voltage is required to produce Roentgen light of a given wave length than when the water has a higher temperature. On the other hand, by using a lower voltage or vacuum and increasing the number of impacts on the target by increasing the amperage, we can make an uncooled target so hot it radiates ordinary light, and yet the tube will not yield a ray of Roentgen light because the force of impact is not great enough to heat the individual particles of the cathode stream sufficiently to produce the short vibrations which are Roentgen light. In practice a very high temperature of the target is not desirable, because the shock of impact of the rushing particles of the cathode stream on such a target is less violent and therefore less efficient in producing the enormous temperature of these particles which is essential. That we are unconscious of this temperature is simply because at present we have no means of producing such rapid vibrations in a sufficient number of particles to constitute a mass such as we think of as a source of heat. We can, however, by using a very high vacuum and voltage, produce a temperature perhaps higher even than our sun, one at which we can decompose some of the so-called elements which, at the ordinary temperatures, are gases, and here the vacuum tube opens a new world.

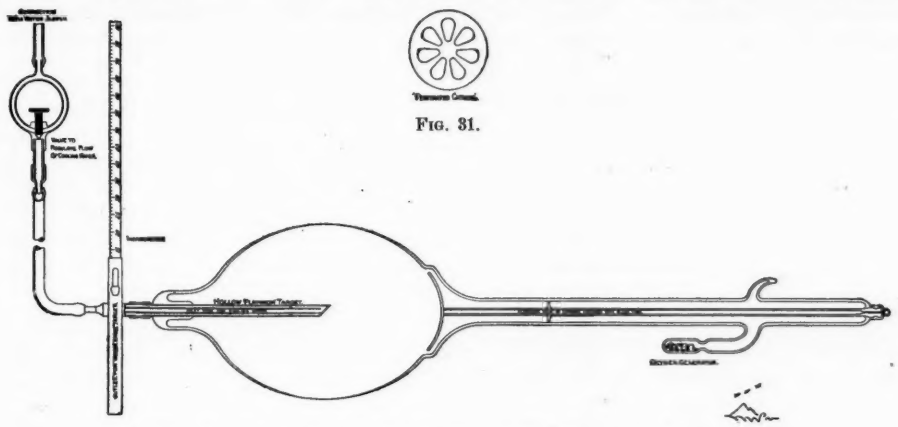


FIG. 30. (SCALE ONE-QUARTER.)—MODIFIED A-W-L ROENTGEN LIGHT TUBE.

NO. XXXI—ON HAVING THE TARGET SEPARATE FROM THE ANODE AND NEARER THE CATHODE.

In Note XVIII it was said that the wave length depended upon the velocity with which particles from the cathode struck the target. As the force of this molecular projection at any point depends upon the rate of change in the potential, it is less at three inches than at a nearer point. Therefore when as shown in Fig. 2, Note XVI, the target is between the terminals, the velocity should be greater than when the target is the anode. By adopting this construction in two terminal tubes we should be able to take advantage of the high initial velocity due to the difference of potential we can maintain by having the terminals three inches apart, and yet by placing the target at one and one-half inches from the cathode, we should cause the molecules to strike it with a higher velocity than they would if they continued their flight to the anode and used this as a target. So with a given voltage we should be able to generate light of a shorter wave length or of the same wave length with a lower voltage. The latter is a matter of some consequence, as it should enable us to use a smaller generator. Another possible advantage is that the cathode discharge is more shielded from the anode rush described in Notes XX and XXI. I have considered two terminal tubes only because this is the type in common use. Mr. Tesla's tubes described in Thompson and Anthony's work on X rays, though a much more interesting form, are at present so rarely employed outside the laboratory of this great discoverer that I have never seen any of them except those I have constructed for my own use. One of these is shown in Figs. D and DI in previous notes in the ELECTRICAL REVIEW. This can be used either as a single or double terminal tube, though it was constructed to combine Mr. Tesla's single electrode with the Crookes and Roentgen plan of bringing the cathode stream to a focus, and to these I added the cooled target. As the statement has been made that the wave length depended upon the voltage, it might be supposed that with the very high potential which can be maintained with such a tube it might not be suitable for generating light of the longer wave length required for distinguishing between the soft tissues of the human body; but this is of no moment, for it is only necessary to use a lower vacuum, thus making the wave length longer by diminishing the velocity of impact. It is practically impossible to get so high a voltage that we can not control the wave length by the degree of the vacuum, and when we can get it high enough we can realize the dream of many now working on this problem and discard the vacuum tube as an essential in the production of this light.

FIG. 31.

NO. XXXII—ON THE SIZE OF CATHODES.

For Roentgen light to be of much use in medical diagnosis it is necessary to have a generator of sufficient power to send the light through the adult body at a distance of at least three feet from the radiant area on the target of the tube. Shorter distances produce marked distortion of the internal organs, a matter of grave importance in studying the heart and determining its real size in disease. This distortion is also a serious matter in estimating the relative sizes of organs lying in different planes, the one farther away being made to appear relatively too big. Six feet is a much better distance, but, unfortunately, there are no commercial generators powerful enough to furnish a proper light at this distance, and such an apparatus is necessarily expensive, costing $1,000 even when made at home. As three feet taxes the best commercial generators to their limit, it is necessary in using the fluoroscope to economize power by sending the electric surges as slowly as is consistent with a steady light. Two hundred surges a minute are said to do this, but Dr. F. H. Williams and I find it necessary to have 1,200 a minute to have the illumination of the screen appear steady to us. As every surge must give force enough to properly illuminate the body, it is necessary to make each of as large an amperage as possible with the generator employed. We do this by filling the condenser as full as we can in one-twentieth of a second, which is the maximum time we can allow force to accumulate for a single surge. When we attempt to deliver this amperage from a cathode of ordinary size the electricity seems to have difficulty in escaping from the concave side of the cathode in a normal manner. As a result we get the lateral sparking mentioned in Note XXVII; and if the cathode is placed in a tube at the end of the bulb and near the walls (as in ordinary commercial tubes before I pointed out the defects of this position), the glass is soon broken. To overcome these difficulties the cathode should be placed as shown in Note XXX, Fig. 30, Note XX, Fig. 5, and instead of being less than an inch in diameter, which is common, it should be two inches or more. These large cathodes are not necessary with small generators. In conclusion, I wish to make two things prominent: the cathode acts as a condenser—the size of the cathode should be in proportion to the size of the surges.

NO. XXXIII—PERFORATED CATHODES.

At a certain stage of the vacuum only the edges of the cathode appear active. At a higher vacuum only the center of the cathode seems to be the source. These appearances have led observers and tube-makers to consider a small cathode as good as a large one. In previous notes I have tried to prove the fallacy of this, and I now print a cut of one of the perforated cathodes I have used in my experiments. A glance at Fig. 31 will show that it has a solid center as large as the average cathode, and a wide, solid rim. If only the edges or center of a cathode were active, this one should be as efficient as though it was solid, but it is not. The cathode stream from it is so broken up and so little delivered at the proper point on the target that this is not made red hot by a current which would melt it with a solid cathode of the same size. The appearances of perforated cathodes of various designs are very beautiful, as are the figures they form on the glass walls, and both are worth careful study.

TOLD IN THE DYNAMO ROOM.--XIII.

"Say, boys, I met the boss uptown just now, and he tells me that Jim and his better two-thirds will be home next Saturday," spoke Benson, the engineer, to Ned and Gus, as he came into the station one afternoon, Ned and the lineman having arrived a little earlier in order to experiment with a new device of Ned's invention, which the latter assured Gus would make him, Ned, independently rich, *if it worked*.

"Is that so?" asked Gus. "I suppose that means I'll have to look for another job next week," a rather doleful expression creeping over his face.

"Oh, I wouldn't worry about that," smilingly remarked Ned, who had taken quite a liking to the young fellow, and had been quietly at work praising his good qualities to Mr. Evans, the superintendent. "In all probability there will be a day circuit running in this city within the next month or two, and you know that means additional help."

"Gee whiz! You don't tell me!" exclaimed Gus; "that'll be all right. I suppose there'll be a motor circuit, and motors are my strong suit."

"Yes, there'll be a two-phase circuit, and then our troubles will commence, especially with the telephone company; you know what shape their lines are in."

"Well, I don't see as that is any of our business," remarked Benson, who by this time had made himself comfortable by taking off his coat and vest and lighting his pipe. "Besides, I don't believe in crossing a bridge before we come to it. By the way, Ned, you promised the other day to tell us some of your experiences with that static electricity we were talking about the day after that storm."

"Yes, let's hear more about it," added Gus; "we have half an hour or so to spare, and your so-called experiences are always interesting."

"Oh, all right, boys," replied Ned, ready to oblige, "only I want Gus to understand that the so called experiences are actual occurrences. As I said the other day, it sometimes takes quite a bit of figuring to locate the seat of static trouble. A peculiar case happened in the Winter of 189–, when I had charge of a lighting plant in Armstrong County. There were two plants in the town; ours ran all night, while the one of the other fellow, as we called him, shut down at midnight and started up again about five o'clock in the morning. One day the other fellows very gravely informed us that our circuits were badly grounded, in fact so much so, that some mornings, when they came to start up again, they could not touch anything connected with their boiler or piping or engine without getting a most terrible shock, as they expressed themselves. Of course I laughed at them, took their electrician into the station and measured the insulation of each circuit before his eyes, but he looked rather dubiously at the bridge I was using, probably never having seen one, and insisted that enough current leaked from our wires, through the ground and water mains to their boiler, to make it necessary to protect the hand with a bunch of waste when turning on steam. Upon my questioning our esteemed competitor as to why the trouble was not noticeable every morning, but only occasionally, he didn't know what to say, but went back, insisting that our lines were at fault. I didn't hear from him for several days, and in the meantime tried hard to find some cause for the other fellows' trouble."

"And did you succeed?" eagerly interrupted Gus, anticipating some novel solution to the problem.

"Yes, but quite accidentally," continued Ned. "You see, I sometimes was relieved at midnight by an assistant, and on such nights went to sleep in a room facing the other plant and scarcely a block away. I often noticed that the boy, left there in charge to keep up steam, occasionally overdid it, with the result that the safety valve would blow every few minutes, and sometimes with a peculiar vibrating sound that made the windows in our plant shake and rattle quite perceptibly."

"Now look out for some of those oscillatory words, Gus," interrupted Benson, knocking the ashes from his pipe and reaching for the bag of Durham.

Ned smiled good-naturedly, and giving Gus a knowing wink, continued:

"Yes, Benson's suspicions are well founded. The escaping steam made me think of a phenomenon I often noticed in connection with a plant up in Minnesota, where, during the Winter, the air is usually very dry. In that plant the arc circuits crossed the railroad tracks at right angles, within a short distance of the railway station. Just inside our engine-room each circuit had a pair of those old-fashioned saw-tooth arresters, just like those we threw away a short time ago. Now I observed that sometimes when a train was passing under the wires and the engine was blowing off steam, those arresters would work, and I could see the blue sparks, accompanied by the crackling noise of the discharge. This gave me the cause of the other fellows' trouble, and as I'm not one of the kind who wants to see another man in a hole, when I can help him out, I suggested a remedy, with the result that they were able to dispense with gloves or bunches of waste after that in trying to turn on steam."

Ned paused and waited for some remarks from either of his listeners. Neither spoke for awhile. Finally, Benson said: "Well, Ned, I think I am beginning to see the point. It was the escaping steam under high pressure that caused some of your static current to be generated, electrifying the piping in one case and those arc circuits in the other."

"Yes, that was it," replied Ned. "Simple, isn't it?"

"Yes, when you know how," gravely remarked Gus.

KIND WORDS.

APPRECIATION OF GOOD ILLUSTRATIONS.

To the Editor of Electrical Review:

I want to tell you how much I admire the half-tone engravings of the Trans-Mississippi Exposition in your issue of July 20. I am something of a photographer myself, and can appreciate excellence in execution. I don't think the results can be excelled. It is the finest work I have seen in *any* electrical journal. Wishing the Review every success, believe me

Sincerely yours,
Henry S. Thornberry.

Washington, July 23.

Decision on Telegraph Stamp Tax.

Application was made to Justice Stover, in the Supreme Court, Brooklyn, N. Y., the other day, for a writ of mandamus on behalf of J. P. Miniter, to compel the Western Union Telegraph Company to forward a telegram without charging the additional one cent for the internal revenue stamp. The mandamus was refused.. Miniter had been to an office of the telegraph company to send a dispatch to his wife at Greenport, L. I. He refused to pay for the revenue stamp, contending that it was the company's duty to affix the stamp.

The Chattanooga, Tenn., Light and Power Company has recently purchased one 2,000-light incandescent machine, one 125-horse power 500-volt generator and one 250-horse-power boiler, to be added to their extensive plant in that city.

ELECTRIC LIGHT FLASHES.

A new electric light company has been organized at Shelbyville, Ill., to purchase the Trout Brothers plant, now in the hands of a receiver.

At the annual meeting of the Sussex, N. J., Electric Light Company, the members of the former board were re-elected, and Ora Harden was re-elected president, J. W. C. Carber, secretary, and J. M. Waddington, treasurer. A dividend of three per cent was declared.

At the annual meeting of the Franklin, Mass., Electric Light Company the following officers were chosen for the ensuing year: C. W. Hazelton, treasurer; E. I. Cassidy, clerk; directors, W. D. Russell, C. W. Hazelton, J. F. Bartlett, P. F. Welch, E. I. Cassidy.

At the annual meeting of the shareholders of the Bethel, Vt., Electric Light and Power Company it was voted to increase the capital stock from $30,000 to $35,000. The new directors are S. M. Washburn, M. A. Moody, E. A. Davis, M. G. Safford, L. M. Heath, W. H. Creamer and Rollin Gilson.

In addition to the regular dividend and rights to subscribe for additional stock at par, the stockholders of the Edison Electric Illuminating Company of Brooklyn will shortly be informed that the cash surplus in the treasury will be divided before the company is transferred to the Kings County Electric Light and Power Company. The amount is said to be between three and five per cent.

W. A. Foote has purchased a three-fourths interest in the Kalamazoo, Mich., Electric Company. The capital stock is $100,000. The plant will be increased and the service improved. The officers are, president, W. A. Foote, Jackson; secretary, S. S. Hurlburt, Battle Creek; treasurer, James B. Foote, Jackson. W. A. Foote is now interested in the Battle Creek, Jackson and Albion electric lighting plants.

The directors of the Albion, N. Y., new electric light and power company have elected officers as follows: President, Frank A. Dudley, of Niagara Falls; vice-president, Albert Culver, of Albion; treasurer, Raymond Johnson, of Buffalo; secretary, Sanford T. Church, of Albion; general manager, Wallace C. Johnson, of Niagara Falls; attorneys, Ely, Dudley & Cohn, of Buffalo, and Sanford T. Church, of Albion.

AN ELECTRIC GUN.

A WONDERFULLY EFFECTIVE ENGINE OF WAR—A LITTLE EXPENSIVE, BUT OTHERWISE ALL RIGHT.

"Archimedes," said a prominent savant the other day, "was right enough with his world-moving lever, but his fulcrum was impossible of attainment, and so was his lever. Now, I am not asking for levers which can't be made, nor for a fulcrum able to handle the earth. I don't want the earth. But give me 'juice' enough, as we electrical people call it, and I'll make a gun which could be installed at Key West and land shells in Havana! Give me the dynamos, engines and storage batteries and the rest is as easy as falling off a log, so far as actual attainment goes. And for such trifling ranges as 20 miles it is all the easier.

"You think that's incredible? Not at all. Let's make a few figures. The range of a gun is determined by squaring the velocity in feet per second, multiplying by the sine and cosine of the angle for maximum range, and dividing by gravity, or as the ordnance officers write it

$$\text{Range in feet} = \frac{V^2 \times \text{sin. a. cos. a.}}{g}$$

which in simple arithmetic means roughly that

$$\text{Range in feet} = V^2 \times .0155$$

This is in vacuo, and of course you must make allowance for air resistance.

"The V^2 refers to the muzzle velocity. In short, it is approximately true that the range increases as the square of the velocity. A gun giving a muzzle velocity of 2,000 feet per second has a range, theoretically, of say 12 miles, while one giving a velocity of 4,000 feet per second would carry 48 miles, and one giving a velocity of 6,000 feet per second would carry about 108 miles. Of course air friction would cut these ranges somewhat. So you see, if I made a gun to give a muzzle velocity of a little over 6,000 feet per second in air, I can throw shells from Key West to Havana. A muzzle velocity of 3,000 feet per second would allow a gun at Sandy Hook to drop shells uncomfortably around the Plaza Hotel at Fifty-ninth street.

"This, of course, is all beyond the power of any powder gun at present known, as even the Jubilee gun had a shelling range of only 13 miles. I have up my sleeve a form of siege-gun which, actuated by powder, would throw a shell 20 miles or more, but that is another story.

"You ask how I'm going to get the required velocity electrically. Well, it is perhaps not easy, but it can be done. All I want is a corking big long solenoid, built in sections, and the sections energized successively, so as to pull on and continuously accelerate a core inside, the core being the shell itself. Do you see what a simple thing that amounts to? The shell would start very gently from a state of rest, and suffering no shock whatever, could be filled with guncotton and a percussion fuse.

"Now, as to the energy required. Take the 20-mile gun and a 100-pound shell. The formula is: Foot pounds $= \frac{W \times V^2}{2g}$. W is 100 pounds; V^2 is 3,000 × 3,000, and 2g is 64.4. This figures out 13,975,000 foot pounds, or 423 horse-power for one minute, or 25,380 horse-power for one second. That is easily attainable electrically, you will admit. At 1,000 volts it would only mean a current of about 19,000 amperes, and nowadays we don't mind a little thing like that. To have the shell acted on during one second, the solenoid-gun would only need to be 1,500 feet long. But we can easily reduce that to 100 feet, if during the one-fifteenth of a second then required to accelerate the shell, we apply a boost of 380,700 horse-power. That, at 3,000 volts, would only mean a current of about 95,000 amperes. The cost of energy for 25,380 horse-power for one second, or 380,700 horse-power for one-fifteenth of a second, at the rate of $150 per horse-power per year, would only be 35 cents for the whole business, which beats any powder gun all to pieces. The gun could be loaded at the breech, and, with a lively automatic loading and firing device, could actually have the unique distinction of loading and firing a shell before the previous shell had left the muzzle. Thus a torrent of shells could be spat out at the rate of 3,600 per hour. That settles Havana if the War Department will let me build a gun or two at Key West.

"The cost of gun and equipment? Now, look here, young man. When a great country like this is at war, we don't stop at such sordid considerations. When Yankee Doodle has his back up in earnest, he never feels in his pocket before he orders his 'gin rickey.' Let's say $1,000,000."

A New Alternate-Current Meter.

The sketches herewith illustrate the new meter for alternate currents now being put on the market by the Electrical Company, Limited, of 122 Charing Cross Road. The meter is a most ingenious one, says the London *Electrical Engineer*, and from tests shown to us seems very accurate. In fact, one curve of calibration is almost too straight for credence. The meter corresponding to this curve was a 10-ampere one, and with that current the motor ran at 40 revolutions per minute. The errors at different parts of the range were as follows:

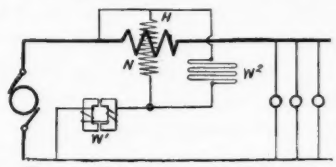
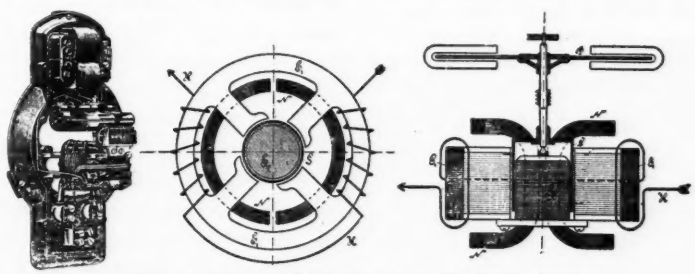


FIG. 4.—DIAGRAM OF CONNECTIONS.

Current.	Error per cent.
.19 amperes.....	+0.25
.99 "	−0.6
4.01 "	−0.31
6.01 "	−0.25
9.97 "	+0.3

The general view of the meter with the case off is shown in Fig. 1. The construction of the meter is seen in Fig. 2 and in the section, Fig. 3.

The motor is constructed on Ferraris's principle for working with single-phase alternating current. The field E_1 possesses four poles with four corresponding pole-pieces, each having an extension on one side, all of which point in the same direction. The series winding H is of the gram type; the shunt winding N is laid in frames inside the poles. The amount of current in the shunt circuit is controlled by an inductive resistance W_1 (Fig. 4) which can be regulated. Thus the speed of the motor can be arranged so as to admit of the consumption being read off direct in hektowatt-hours or kilowatt-hours, and the necessity for a constant is obviated. The armature core E_2 is fixed, while the armature, formed of a bell-shaped piece of copper G weighing about 50 grams, revolves. The relative arrangement is such that part of the weight of the copper armature is counteracted by the Thomson effect, so that the actual weight of the revolving portion on the bearings is less than 50 grams. The motor works against a Foucault brake, shown by D (Fig. 3) which rotates between permanent magnets.



FIGS. 1, 2 AND 3.—A NEW ALTERNATE-CURRENT METER.

In order to make the meter as sensitive as possible under a very light load, the armature is so arranged that its torque, by reason of the above-mentioned extension of the pole-pieces, is somewhat greater than the mechanical friction, so that the armature, under the influence of this force, tends just to rotate continuously by the action of the shunt. To prevent the meter from running idle in this manner, a small piece of iron wire is attached to the damper, so as to be attracted by the permanent magnets; it is so bent that the meter remains motionless so long as no main current passes through, however violently it may be shaken. Nevertheless, the slightest action of the main current suffices to cause the meter to start. After being switched out of circuit the rotating portion completes one more revolution, until arrested by the action of the permanent magnets upon the above-mentioned piece of iron. The meter can be relied upon with absolute certainty to register under even one-half per cent of the maximum load. There being neither collector nor brushes on this apparatus, the only mechanical resistance worth consideration is the friction in the lower bearing, for, as the spindle is vertical, that in the top bearing is of no importance.

The current taken by the shunt circuit is kept by careful design so low that only about one watt is wasted in the circuit. Meters hitherto constructed upon the Ferraris principle do not take into account the lag of phase in inductive circuits, but only that occurring in the shunt circuit within the meter itself; to measure inductive circuits with accuracy it is necessary that the artificial difference of phase in the shunt shall amount to exactly 90 degrees. In the present construction, this lag of phase of 90 degrees is attained by adding to that of the separate choking coil the lag in the motor itself, arising from the non-inductive resistance, W_2 (Fig. 4), which is connected in parallel with the shunt winding of the motor. The readings of the meter depend upon the number of alternations; it is, therefore, necessary to calibrate the meter in accordance with the periodicity adopted by each individual central station.

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SPECIAL NOTICE TO ADVERTISERS.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue.
NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

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We should keep the Philippines. We believe we can assure President McKinley that this is the unanimous sentiment throughout the vast electrical industry. It is no doubt the belief, also, of every American citizen who realizes his obligation to extend civilization and who appreciates this opportunity to advance the interests and uphold the honor of his country.

Suggested refrain for a chorus to be sung by the stockholders of the Electrolytic Marine Salts Company: "Done again! Jernegan gone again! Will he pay back again? Ne'er again!"

Peace would soon be declared if the United States owned two or three electric guns, such as the one described on another page of this issue of the ELECTRICAL REVIEW. It is a wonderful piece of apparatus conceived by a man with a rubber imagination.

The principal electrical manufacturing companies are understood to be turning out the largest shipments of goods made in recent years. The margin of profit is not as high as formerly, but is said to be satisfactory. The electrical field generally is in good shape financially.

New York has at last decided to abandon her horse cars. With their abolition one of the picturesque features of her metropolitan life will disappear. They should have disappeared years ago. The sight of the slow, creeping cars and the occasional publication with detailed amplification of runaways of horse-car teams have long been a source of amusement to Philadelphians visiting New York. Anyhow, New York is to be congratulated. Greater New York with horse-car lines has been a solecism.—*Philadelphia Press.*

When Philadelphia gibes at us we weep indeed!

The ELECTRICAL REVIEW has already remarked that, aside from the fighting equipment, the electric searchlight is the most important piece of apparatus on a man-of-war. Admiral Sampson's report and the reports of his officers show that it was due to the intelligent and effective use of searchlights that Admiral Cervera dared not attempt an escape from Santiago Harbor at night, and, therefore, was forced to "make a run for it" at what he supposed was the most favorable time during daylight. Great is the searchlight!

Motorman C. F. Fisher, of Elizabeth, N. J., by his coolness and presence of mind, saved the lives of 40 passengers on a trolley car while running between Newark and Elizabeth one day last week. As he was approaching a steam railway track, an express train rounded a curve only a short distance away. Fisher's car was too close to the track to stop in time to avoid a collision, so he threw the controller over to the limit, the trolley car dashed ahead, and the train just missed the rear platform. "Peace has its heroes as well as war."

Some months ago the merchants along Sixth avenue, in New York city, wailed loud and long because the horse cars on that thoroughfare were not replaced by underground trolley cars. The Metropolitan Street Railway Company began installing the electric system on Sixth avenue last week, and, in order to accomplish the work as rapidly as possible, suspended the horse-car service. Now a yell and a howl goes up from the merchants because, for a few weeks in the dullest season of the year, there are no street cars on the avenue. President Vreeland, of the Metropolitan Street Railway Company, is undoubtedly doing what one would expect of a practical street railway man—looking out for the interests of his company and the convenience of the traveling public.

The battleship "Texas" reached New York last Sunday, the first of our ships to return after the glorious victory over Cervera's squadron. As she dignifiedly moved up the East River, steam whistles and cheers greeted her enthusiastically. Her battle scars were admired and commented upon with glowing pride by hundreds of visitors who went aboard after her arrival at the Navy Yard. Her officers and crew brought many souvenirs from the Spanish ships. The one most highly prized is a fine searchlight in perfect condition, captured from the "Vizcaya," and now mounted on the starboard quarter of the "Texas." While shooting at the "Vizcaya" the concussion from one of the "Texas's" 12-inch guns completely shattered one of her own searchlights and the defeated Spaniard was forced by fate to supply the deficiency.

PERSONAL.

Mr. Henry S. Winston, formerly in the electrical business in Chicago, now with the Mutual Life Insurance Company, at Omaha, was a New York visitor last week. His brother, Mr. Fred Winston, is a prominent young attorney of New York city.

A press dispatch says that the steamer "Harlow" on her next trip from Cape Breton to Halifax will call at St. Peter's for Prof. Alexander Graham Bell and land him on Sable Island, where he will search for the bodies of his friends, Professor and Mrs. Pollock, who were lost in the "La Bourgogne" disaster.

Mr. Walter S. McQuaide, brother of Mr. James P. McQuaide of the National Conduit and Cable Company, has joined the United States Volunteer Engineers, and is a member of Company A, First Regiment, at Camp Townsend. Col. Eugene Griffin is in command of the regiment, which is expected to start to the front this week.

Mr. H. T. Cedargreen, managing director of the General Telephone Company, of Stockholm, Sweden, and Mr. Johansson, of the same city, are making a tour of this country in search of the newest and best developments in the telephone field. They spent several days inspecting the system of the New York Telephone Company, under the guidance of general manager U. N. Bethell, and then proceeded to the West.

Mr. A. J. Churchward, for many years connected with the Excelsior Electric Company and well known in electrical circles from his advanced work with single phase, alternating motors and rotary transformers, has accepted a position with the Fort Wayne Electric Corporation, Fort Wayne, Ind., and will hereafter devote himself to the transmission work, into which the Fort Wayne people expect to enter largely as soon as their new factory is completed. Among the latest inventions of Mr. Churchward is a unique brush holder, which, we are informed, the government has adopted as standard.

A discussion of the relations between the purchaser, the engineer and the manufacturer is always interesting and sometimes profitable. Mr. William H. Bryan read a paper on this subject before a recent meeting of the American Society of Mechanical Engineers. The first part of the address appears in this issue of the ELECTRICAL REVIEW, and merits the attention especially of electrical engineers.

WESTINGHOUSE APPARATUS FOR LONDON.

EXHIBITION AT EAST PITTSBURGH OF GENERATORS AND ENGINES.

The Westinghouse Electric and Manufacturing Company and the Westinghouse Machine Company entertained at their East Pittsburgh, Pa., shops last Saturday about 500 guests who had been invited to view and inspect a collection of electrical apparatus and engines which will be shipped immediately to London.

The machinery on exhibition embraced everything from a generator, capable of furnishing 2,500-horse-power, to a Tesla five-horse-power motor. Between these extremes were generators, motors and engines capable of greater or less energy, together with unassembled fields and armatures destined for the European market. In fact, the greater portion of the exhibit was for shipment to London. The big equipment goes to the Metropolitan Electric Supply Company, the greatest electric lighting and power company in London. The apparatus shown at the East Pittsburgh plant is to supply arc and incandescent lights for London, as well as to operate rotary transformers to supply current direct to motors, and for charging storage batteries by the three-wire system.

This order, large as it is, is believed to be merely the first of others to be placed. The Metropolitan company is about to establish new central stations all over London, and proposes to equip them with the largest type of generators, engines and motors. The stations of the concern operated at present are also to be newly equipped and increased in power capacity, and it is generally believed that the Westinghouse company is to supply the power apparatus. Altogether the present order of the London concern calls for three 2,500-horse-power generators, three 2,500-horse-power engines, three compound two-phase steam alternators, together with motors and other equipment. The Westinghouse company states that this apparatus is the largest of its type ever manufactured.

In addition to an inspection of these engines and generators the visitors were shown through the gas-engine department, the power plant, casting and moulding works, machinery department and draughting rooms. Interest was shown in the steam turbines. One driving a 200-horse-power alternating-current generator was in operation. This turbine is a somewhat new form of steam engine. It makes use of the high velocity attained by steam in passing through an orifice from a higher to a lower pressure much in the same manner as a water turbine. The one on exhibition runs at 4,700 revolutions per minute, and without perceptible vibration.

Wall Street and the Electrical Stock Market.

The stock market during the past week was marked by pronounced changes in a few stocks only. Prices advanced somewhat on Tuesday and Wednesday, influenced by the prospects of peace. On the New York exchange General Electric closed to-day at 39⅝, showing an advance of ⅜ for the week. Western Union closed at 93, gaining ½ point during the week. On the Boston exchange American Bell closed at 277, bid, and 278 asked. General Electric preferred closed at 94 bid and 96 asked. On the Philadelphia exchange Electric Storage Battery common closed at 35¼ bid and 35½ asked.

The Carty bridging-bell decision, published in full in the ELECTRICAL REVIEW last week, created much interest in financial circles. A dispatch from Boston to a New York news agency stated that the news of the decision caused an advance of $5 a share in American Bell stock.

The Chicago Edison Company has sold 350,000 new five per cent gold bonds on a four and one-half per cent basis, making $3,325,000 of this issue now out.

Wall Street, July 30.

Storage Batteries for the South Side Elevated Road, Chicago.

The Electric Storage Battery Company, seemingly not content with the honor of having installed the largest battery in the world used in a lighting station, last week closed a contract with the South Side Elevated Railroad Company, of Chicago, for two batteries, each of 500 kilowatts capacity. One of these batteries will be installed on the company's property at Twelfth street, and the other at Sixty-first street, and will be used to regulate the fluctuations of the load and to maintain an even potential at extreme points on the line. Both batteries will be installed with tanks and bus-bars of sufficient size to permit of doubling the capacity, should that be found to be desirable.

These batteries, when completed, will comprise the largest storage battery installation for railway feeder regulation in this or any other country. The first set of batteries is expected to be ready for use by September 15 next.

Telephone Switchboard Injunction Denied.

In the case of the Western Electric Company vs. Kellogg Switchboard and Supply Company, in which the complainant sought to restrain the defendant company from installing a switchboard for the Kinloch Telephone Company, of St. Louis, Judge Showalter, of the United States Circuit Court at Chicago, on July 29, denied the preliminary injunction asked for.

The Kinloch Telephone Company is probably the most formidable competitor which has yet entered the field against the Bell telephone interests. It is establishing an exchange in St. Louis in which it has laid about 105 miles of conduit, expended over $1,000,000, has about 5,000 instruments already installed, and the switchboard will be completed, and service for subscribers will commence within a few weeks.

The complainant applied for an injunction on the Firman patent, which expires on January 19, 1899, and the validity of which had been recently sustained by Judge De Haven, of the United States Circuit Court, Northern District of California. The decision in California has been appealed to the United States Circuit Court of Appeals; and relying upon that decision the complainant sought to obtain an injunction and thus prevent the Kinloch company from beginning operations as had been planned.

It was claimed in the affidavits of Prof. Elisha Gray, Professor Carhart, of Michigan University, Milo G. Kellogg and F. W. Dunbar, that there was no infringement. Professor Jackson, T. D. Lockwood, C. E. Scribner and others gave contrary affidavits.

The court stated in substance that it was his impression that there was no invention in the Firman patent; that he was unable to see upon what ground Judge De Haven had sustained the validity of the patent, in view of the prior state of the art, and especially in view of the Dumont English patent of 1851, and advised counsel for complainant that, in his opinion, if the case went to the Circuit Court of Appeals, they would have great difficulty in sustaining that opinion.

He also stated that one of the decisions cited by Judge De Haven in his opinion had been discredited by the Circuit Court of Appeals of this circuit in an opinion filed but a few days ago, and that it was very doubtful, to his mind, whether there was any invention in the Firman patent, or, if there was invention, it was extremely doubtful if defendant infringed. He said, however, that he preferred to place his decision at this time broadly upon the principle that the telephone company at St. Louis was engaged in a public service; that the question was doubtful; and that the defendant switchboard company was undoubtedly solvent and would be able to pay any damages that might be recovered if the complainant should succeed in establishing the validity of the patent and the fact of infringement; and that it would, under such circumstances, and also in view of the early expiration of the Firman patent, be an abuse of discretion for him to entertain the petition for an injunction, which he therefore denied.

A Cable to the Philippine Islands.

A press dispatch from San Francisco says it is reported that a contract for laying a cable between the United States, Hawaii, the Ladrones and the Philippines has been let, and that communication over it will be possible within a few months. Most of the surveys have been made, except some soundings between Hawaii and the Ladrones. It is understood here that the contract was made with the Pacific Cable Company after the government had sounded enough members of Congress to make sure of the annexation of Hawaii and the passage of the Pacific cable bill.

The Pacific Cable Company was organized with a capital stock of $10,000,000. James Scrymser is president; Edmund L. Baylies, vice-president, and other directors are Admiral John Irwin, J. Pierpont Morgan and J. Kennedy Tod. On July 2 the Executive Council of the Hawaiian Government signed a contract granting to the company the right to lay a cable between the United States, Japan, China and "the Pacific islands." The contract is for a period of 20 years.

Congressman Bennett's Pacific cable bill authorizes the Postmaster-General to contract with the Pacific Cable Company for the transmission in perpetuity of official messages of the United States for $100,000 a year for 20 years. The bill was reported favorably by the commerce committee and then shelved. Neither House nor Senate has taken any action on it, but its passage is said to be assured.

The company, it is said, will begin work at Honolulu. The first to be laid will be cables to the United States and the Philippines. This would explain the government's anxiety to get possession of the Ladrone Islands before Spain could cede them to any foreign power, for St. Ignazio de Agana, on the island of Guam, was needed for a cable station as well as a naval station. The island is on the direct line between Hawaii and the Philippines, and is necessary to the maintenance of the cable between the two groups.

The Pacific Cable Company has already let a contract for laying the cable, and construction will begin immediately. It is understood that the contract calls for the completion of the cable within six months, and its cost will be more than $10,000,000.

THE BEST AVAILABLE INCANDESCENT LAMP FOR CENTRAL STATION USE.

ABSTRACT OF A PAPER READ BEFORE THE NORTHWESTERN ELECTRICAL ASSOCIATION, JUNE 11, 1898, BY S. EVERETT DOANE.

I believe there is no ground for debate on the two following statements:

1. The candle-power of an incandescent lamp never remains absolutely constant, and barring the first sharp rise, it constantly falls.

2. The curve of change in candles in an incandescent lamp is nearly a straight line, and for all practical purposes can be considered as such. This, of course, neglects the first rapid rise in candles and the sudden slump at the finish, when the defect, which finally causes the failure of the lamp, has reached the acceleration period of its development.

In spite of curves, figures, statements and discussions, the belief is still general that the sole gauge of the difference of illuminosity is the difference between the initial candles and the candle-power at the end of a predetermined number of hours.

This is rarely the case. Almost all incandescent lamps immediately rise in candles. This preliminary rise is very rapid. The maximum candles are frequently reached after the first one or two hours. Such being the case, what is the true initial candle-power of a lamp under test, and how much has the candle-power rating to do with the ultimate decision of the would-be purchaser?

Why should a lamp be bought and termed "16 candle-power" when, within an exceedingly short space of time, it gives 18 or 19 candle-power?

Should a purchaser of a three-watt lamp be pleased if, by its rise in candle-power, it produces light at the rate of two and one half watts per candle, but subsequently suffers a rapid decrease in brilliancy because of this high filament temperature? Would it not have been better, if illumination at the brilliancy produced by filaments at a two-and-one-half-watt temperature was desired, to have consulted some lamp engineer, with a view of producing this extraordinary condition in the best engineering manner? Would any of you dream of overloading your generators, deliberately closing your eyes to their obvious overheated condition, and invite final disaster, because your generators were rated to operate at a given number of amperes, and your ammeters lied?

This suggests a question once asked me by one of the early Thomson–Houston "experts" sent out to install incandescent lamp apparatus. I was called upon to settle the following dispute: The old Thomson–Houston spherical armature, shunt-wound, direct-current lighting generators had upon their fields an outer winding of resistance wire, so that, by means of a sliding contact, the attendant could adjust the current on the fields and keep his voltage constant. This "expert" knew that, by sliding the movable contact along the field and cutting out the resistance, the lamps would become more brilliant. When remonstrated with by his mates for running his lamps too high, he replied that it did no harm. It made the lamps brighter, but did not increase the voltage of the dynamo. It was a 110-volt machine and 110-volt lamps, and as it did not increase the voltage on the lamps, they did not suffer injury, but only burned brighter.

Is it wise to buy lamps labeled 16 candle-power if, after the first five hours, they rise to 18 and subsequently fall to 14 candle power or less, giving you very bright and, comparatively, very dim lamps on your circuits side by side? But such lamps have caused lamps really well made to be considered inferior, because the area of candle-power of the latter was less, although the real maintenance of candle-power was superior.

Why should a manager desire a lamp which rises in candles? If he buys a 16-candle-power lamp is he purchasing a lamp which he wishes to deliver 18 or 20 candles, or more, after a few hours? Is he not deceiving himself? Would it not be better for him to understand that he is purchasing an 18-candle-power lamp? Would it not be better for him to buy one actually 18 or 20 candle-power, which would not rise in candles? He could thus secure the benefit of the difference between 16 and 20, when the poor lamp was rising, and before it reached the peak of its curve, and at the same time view the conditions of illumination with his eyes wide open.

There are differences of opinion as to whether or not it is good or bad policy to deceive your customers. In the writer's estimation it is decidedly bad. This without regard to the moral status of the question. There should be no discussion as to whether or not a man should deceive himself.

Fortunately it is not essential in discussing a lamp test to find just the height to which a lamp rises, as the most satisfactory lamps do not rise in candles, or at least rise very little, and reading on these lamps will show that the candle-power curve almost from the beginning is very close to a straight line.

To refer back to the original question, what is the proper rating? Should not the definition of initial candle-power be the maximum candles during any part of the life? Should not the difference between the maximum and minimum candles be the gauge of the lamp's performance? It would seem to me that by far the best rough method of analyzing a lamp test is to add the per cent increase to the per cent decrease in candles, and call it all decrease. A few of us are guarding against this rise in candle-power and trying as hard to overcome it, as we are the fall.

After the test it is not unusual for the purchaser to demand that lamps delivered shall not exceed the watts per cent of the lamps under test, so that the lamp manufacturer is immediately obliged to build lamps which shall average less watts per candle than the lamps under test, with a resulting disappointment to the station manager, because the performance of the lamps in service is not equal to that of the test, under which they were purchased. It would point toward a uniformity of practice if it could be understood that the watts per cent specified on a set of specifications are the average initial watts per cent, rather than the maximum limit.

If the smashing point of an incandescent lamp is at that time when the candles have reached a given percentage of their maximum value, that lamp is best which, starting at the same intial candles as its competitor, makes the nearest to a straight line to the percentage of maximum candles which has been set at a proper smashing point. This, of course, affords a comparison only between lamps starting at the same initial watts per cent.

The belief seems to be growing that the value of a lamp to a station can be obtained by putting a planimeter on a lamp curve, and averaging thereby the candle power hours to the time when by reaching a given percentage, 80, for instance, of its initial candles, it has reached its smashing or breaking point. This seems to me to be wrong, as it places a premium upon the rise in candles before mentioned. The advocates of this proposition really discredit it when they limit the initial efficiency of a lamp, for, if this really were a gauge, lamps of greater economy, i. e., consuming much less energy per candle, would be adopted.

It may not be generally appreciated that the cost per average candle-power hour constantly decreases as the candle-power for a given total wattage is increased, that is, when the average economy is lessened. To illustrate: A 24 candle-power lamp taking 60 watts, that is, two and one-half watts per candle, providing it does not break, gives a greater illumination for a given consumption of watt hours through a period well past the economical smashing time than a 20 candle-power three-watt lamp.

Szcepanik's Telectroscope.

[*From the London Electrician.*]

Although the specification of the patent granted to Messrs. Jan Szcepanik and Ludwig Kleinberg, for a "method and apparatus for reproducing pictures and the like at a distance by means of electricity," has already been published several weeks, it still seems to be believed in some quarters that a practical method of "seeing by telegraph" is about to be evolved. In order that our readers may know what little ground there is for any such supposition, we will briefly describe what these two ambitious Austrians think they have invented. In their apparatus at the transmitting end they use two narrow strips of mirror, placed at right angles to one another, and made to oscillate by means of electro-magnets. The picture to be transmitted is reflected in lines by the first mirror onto the second, and by the latter it is split up into points. The rays for the second mirror are reflected through an aperture onto a selenium cell, consisting of an annular layer of selenium mounted in a brass disk, which is slowly rotated by clockwork, so that a fresh portion is constantly exposed. Brushes connect this selenium cell to a battery and the line, and the circuit is completed by an electro-magnet at the receiving end. This electro-magnet moves a prism upon which a ray of sunlight or artificial light falls, and part of the spectrum is received through an aperture on mirrors placed at right angles to one another and oscillating in synchronism with the mirrors in the transmitter. The action, which is expected to take place, is described as follows in the words of the specification:

The rays, which are converted into electric currents of various strengths, according to the color of the light emitted from the several picture-points, produce at the receiving station a corresponding energizing of an electro-magnet and the consequent movement of a prism in such a manner that only a ray of similar kind of the light falling from a source of light onto the prism and becoming decomposed thereby, can reach the synchronously oscillating mirrors at the receiving station. The reflecting action of these mirrors is such as to cause the picture-point transmitted to the eye of the observer to be visible to him at the place and in the color corresponding to the point at the transmitting station.

We do not wish to discourage Messrs. Szcepanik and Kleinberg, and we hope they will continue to work at their problem, whether the old idea of using a selenium cell be the basis of their endeavors or not, but we would suggest to them that, unless they have unlimited funds at their disposal, they will be ruined in fees if they patent their invention in such very small increments during its process of evolution. They have had at least one practical idea, however, for in one of the claims of the specification they cite the combination of a telephone set, with the transmitting and receiving instrument, the object doubtless being that the operators at the two ends shall be able to tell one another what it is they ought to see.

The Relation of Chemistry to Electrical Engineering.

[*From the London Electrical Review.*]

A prediction as to the future possibilities of electricity would hardly be complete without a mention of its application to chemistry, and the probabilities are that developments in the near future will show even more clearly than at present the close relationship between chemistry and electricity.

The science of electro-chemistry is one of great importance to the electrical engineer from two opposite points of view. The promise has been made that discoveries in this science will furnish the means of transforming chemical into electrical energy, whereby energy in a useful form may be obtained direct from coal; and if this promise is fulfilled, even to the extent of economically transforming 10 per cent of the energy of carbon directly into electrical energy, the influence on the present methods of power generation can hardly be estimated. On the other hand, the transformation of electrical into chemical energy offers the electrical engineer an advantageous method of disposing of energy in the manufacture of useful chemical products. The former prospect is one almost entirely of the future, while the latter is already one of industrial importance at the present time.

In the whole engineering field there is probably no section about which less is generally known, and in which the refinements of the best engineering practice have been less applied than in electro-chemistry. From its great importance and the wonderful possibilities presented by it, such a condition of affairs may seem surprising, but it may possibly be attributed to the fact that all who have been actively engaged in this line of work very jealously keep their processes secret, and what has actually been accomplished in this field, and the knowledge of methods used is by no means common property. Some of the leading manufacturers using electro-metallurgical and electro-chemical processes frankly admit that it is not their policy to take into their employ ambitious young men of technical training to learn the business unless they are financially interested, and that it is to their interest to keep the details of their business in as few hands as possible.

Although there is apparently a considerable amount of electro-chemical literature, a large part of it is unreliable and misleading, from the fact that it is largely derived from patent specifications, in which any number of claims are made, but no reasons are given as to why these claims can not be realized in practice, and there is a remarkable dearth of published data derived from practical working on an industrial scale.

The advantages to be derived from electro-chemical industries are manifest to both the chemist and the electrical engineer, for to the former it means a new and cheaper method of manufacture and the possibility of obtaining substances which could be obtained in no other way, while to the latter it offers a possible means of solving some of his hardest problems, such as the utilization of water-power without long-distance transmission, and the raising of the central station load factor to a value which will enable the equipment to be utilized to its full extent. That some progress in this direction is being made is shown by the fact that over one-half of the power contracted for at Niagara Falls is to be used in electro-chemical processes.

The consumption of energy for electro-chemical or electro-metallurgical processes seems to offer an ideal solution for the second problem. This is especially true if the operation is one that can be started and stopped at any time, and in which the amount of power may be varied at will. With such a condition of affairs we should have a load greatly superior to any day load at present, in that it would be absolutely steady and would not overlap the lighting load. Although such a load could be obtained by an efficient method of power storage, all methods which have been proposed for this purpose involve a large percentage of loss in the transformation of energy, as well as an expensive equipment, which greatly increases those important items on the books of central stations; namely, "interest" and "depreciation." If the surplus energy could be utilized in producing some marketable product, the interest and depreciation upon the extra investment would represent a portion of the cost of the article produced, and would not enter as an item of expense into the operation of the power station.

From the chemical engineer's standpoint the question is: Where can power be obtained in sufficient quantity and at a low price? He might obtain it from the central station, paying for it at the usual lighting rates. A greatly reduced rate could be obtained from the same station, however, if the power is to be used only during certain portions of the day; that is, when there is slight demand for lighting current. In order, however, to avail himself of this rate the cost of the electrolytic equipment for utilizing the current must be low enough so that the interest and fixed charges upon the capital invested in apparatus shall not be great enough while the apparatus is not in use to offset the saving made by the reduced rate for power. If large and continual amounts of power are required an efficient steam plant might furnish the energy at a small cost per horse-power hour. The utilization of water-power seems to be the ideal source of supply for electro-chemical work; but here, again, a limit is placed, from the fact that if the power is at a considerable distance from industrial centers the transportation rates on the raw material and the finished products will generally overbalance the saving made in the cost of power, and, as a result, electrolytic industries deriving power from steam plants are successfully competing with water-driven installations.

Among other sources of cheap energy which may enter into competition may be included power plants located near coal fields, where fuel obtained at the actual cost of mining could be used; also power plants deriving their energy from the waste gases of blast furnaces and coke ovens, which energy is far more than sufficient to supply the power now utilized in such works. The principal problem for the chemist, then, is not how to obtain a cheap source of energy, but to develop and perfect the electrolytic apparatus, so that the energy may be utilized.

There is a very substantial paper on this subject by Mr. C. F. Burgess in the *Wisconsin Engineer*, Vol. ii, No. 2, pages 134–142, which is well worth careful perusal by those of our readers who are responding to the growing interest in electro-chemical work. Mr. Burgess not only indicates the directions in which new enterprises may possibly succeed, but, which is equally valuable, points out the roads along which those who travel will encounter failure.

The paper contains a scholarly classification of the chemical changes which can be effected by an electric current, and explains the properties by virtue of which these changes are brought about, and then comes illustrations from processes which are actually being commercially exploited at the present time. Papers such as his are most acceptable at the present time, when some of the best men amongst us, not to mention some of the most substantial capitalists, are being attracted to the problems of industrial electro-chemistry.

American Street Railway Association.

The following are the committees which have been appointed to take charge of the several details of the convention of the American Street Railway Association, which will be held at Boston, September 6 to 9:

General Committee: C. S. Sergeant, 101 Milk street, Boston, chairman; E. C. Foster, Lynn; J. E. Rugg, Boston; C. S. Clark, Boston; A. A. Glasier, Boston; C. Q. Richmond, North Adams; John R. Graham, Boston; Robert S. Goff, Fall River; P. L. Saltonstall, Boston; E. P. Shaw, Boston; F. H. Dewey, Worcester.

Committee on Entertainment: P. L. Saltonstall, Boston, chairman; H. F. Eldredge, Portsmouth; A. B. Bruce, Lawrence; C. C. Pierce, Boston; C. E. Barnes, Boston; C. W. Wilson, Boston; J. F. Shaw, Boston; J. H. Goodspeed, Boston; J. H. Cunningham, Boston; B. J. Weeks, Quincy; W. W. Sargent, Fitchburg.

Committee on Hall, Hotels and Registration: E. C. Foster, 333 Union street, Lynn, chairman; John F. Morrill, Quincy; J. N. Akarman, Worcester; J. H. Studley, Jr., Boston; J. E. Rugg, Boston; W. F. Pope, Boston; R. N. Wallis, Fitchburg; H. B. Parker, Boston; A. E. Smith, Springfield; George F. Seibel, Taunton.

Committee on Exhibits: Chas. S. Clark, chairman; H. F. Woods, Boston; E. C. Foster, Lynn; C. F. Baker, Boston; E. P. Shaw, Jr., Boston; Franklin Woodman, Haverhill; R. S. Goff, Fall River; J. H. Studley, Jr., Boston; Maurice Hoopes, Lynn; A. C. Gardner, New Bedford; E. S. Webster, Boston; W. F. Pope, Boston.

Committee on Transportation and Information: Julius E. Rugg, chairman; N. H. Heft, Boston; H. B. Rogers, Brockton; J. F. Wattles, Boston; Fred H. Smith, Quincy; A. E. Gordon, Boston; N. E. Morton, Lawrence; C. E. Woodward, Wakefield; Winthrop Coffin, Boston; H. H. Reed, Fall River; H. F. Grant, Boston.

Committee on Banquet: A. A. Glasier, chairman; W. A. Bancroft, P. Cummings, Boston; C. S. Clark, Boston; E. P. Shaw, Boston; E. C. Foster, Lynn; S. M. Thomas, Taunton.

American Electro-Therapeutic Association.

The eighth annual meeting of the American Electro-Therapeutic Association will be held at Buffalo, N. Y., on September 13, 14 and 15. An elaborate programme of addresses by prominent electro-therapists has been prepared, and Dr. Wm. J. Morton, of New York city, will deliver an illustrated lecture on the X ray. The meeting will be held in the Library Building, where there will also be an exhibition of medical electrical apparatus. The Hotel Iroquois will be official headquarters.

TRANSFORMER ECONOMY.

READ BEFORE THE NATIONAL ELECTRIC LIGHT ASSOCIATION, CHICAGO, JUNE 8, 1898, BY PROF. WINDER ELWELL GOLDSBOROUGH.

(*Concluded from page 62.*)

In connection with oil insulation it must be remembered that its efficiency as an insulating medium is impaired by discharges in the oil. One of the foremost claims made in behalf of oil insulation is that it will flow in and fill up a rupture in the insulation of the coils. Every electric discharge that takes place through the oil, however, disintegrates and breaks up the normal structure of the oil, and causes carbon and other conducting compounds to form. These will rapidly multiply if the discharges are at all frequent, and will destroy the insulating properties of the oil.

As a case in point, and I presume you may know of other similar instances, I want to call your attention to a very good example of what good practice vs. bad practice will accomplish.

There is a city in the West in which the conditions under which electricity is supplied for incandescent lighting are somewhat unusual. There are two companies interested in the business, and both employ the alternating-current converter system of distribution. The plant that is operated by the older company was installed about six years ago, and its equipment has grown slowly from year to year as business expanded. Its development has followed the waves of evolution modifying electric lighting practice within this period with a lag factor approximating 90 degrees. The plant has some strictly modern machinery, but much of the line equipment is old. A number of its transformers have been burned out on account of defective insulation, some have been burned out by lightning and some have shown their efficiency by getting so hot when switched in on an all-day schedule, under light load, that the "oil used to insulate them boiled up and over and ran down the outside of the cases."

It is needless to say that in the latter type of transformer the hysteretic losses were considerable. The transformers were, however, manufactured by a firm of high commercial standing.

The lines of the old company are not protected by lightning-arresters except where they enter the station, and the secondaries are not grounded.

The new company has been in operation two years, and its plant is thoroughly up to date and highly efficient. Oil-insulated transformers of from 80 to 200 lights' capacity are used, and are kept in continuous service. The transformers are of modern design, and stand an insulation test of 7,000 volts, without oil. The lines of the new company run over those of the old company, and are protected about every 1,500 feet by lightning-arresters. None of the secondaries of these transformers are, however, grounded, and magnetic shields are not used. The new company has never experienced any trouble from burn-outs of any kind, although its lines are very much exposed. In a very violent electric storm which occurred some time since, in which the service of the old company suffered in consequence of transformer burn-outs, the service of the new company was not interfered with in any way, although lightning struck its lines several times.

There has been a great deal of interest expressed recently in the effort to formulate a definite set of specifications covering the construction and insulation of transformers, with the end in view of decreasing the fire hazard and supplying the necessary protection from loss of life and property to both the producer and consumer of electrical energy.

In a letter that I have lately received from a gentleman who is much interested in the success of this project, he says that after corresponding with a number of makers, engineers and lighting companies to obtain suggestions as to the remedies for the troubles arising from crosses, lightning, insulation, break-downs, etc., the results were very unsatisfactory, as there seemed to be a vast difference of opinion.

I have read a great many articles for and against the use of earthing devices, grounded shields and grounded secondaries, but I am yet to be convinced that the prominent American practice of high insulation resistance to a disruptive discharge and a plentiful use of well grounded short air gap lightning arresters, does not give a sufficiently good protection.

As I have already remarked, the number of modern transformers that are reported as burning out is relatively very small. By far the greater portion of the troubles arise from crosses between the high and the low-potential circuits, and in such cases the loss must be attributed to faulty installation and not to any imperfection in the transformer.

An oil insulated transformer for use on 2,500 volt primary circuits, or less, having a maximum temperature at full load not exceeding 65 degrees centigrade and designed to stand an insulation test without oil of 750 volts for five minutes, and a prolonged test of 10,000 volts with oil, will be in slight danger from lightning discharges if protected within a distance of 500 feet by a properly installed lightning arrester.

A transformer should also be able to stand a double primary potential test for five minutes, and the insulation test should be made between the coils and between each coil and the core.

In the case of transformers to be used exclusively on very high voltage circuits these considerations do not apply, nor should this paper be considered as dealing with this class of alternating apparatus, which has come to form a department by itself.

In considering the economy of transformers, the problem before us is not so much a discussion of their efficiency as a converter of electrical energy, as it is a discussion of this efficiency in connection with the numerous extraneous causes that tend to make the transformer a menace to life and property.

To my mind a great deal would be gained if an understanding could be brought about between the makers and purchasers of transformers that would result in a uniform practice in the several departments of transformer design. The manufacturers would work to better advantage by having definite specifications to work to, and the way would be open for a bonus or forfeit in equitable proportion to an excess of or shortage in the economy of the product. The fad at present tends toward over-protection. It is bad practice to run to extremes in any department of engineering, and too much protection may turn out to be just as costly as too little.

Local Street Railway Travel in Chicago.

Nearly every one carries about in his mind an idea of the magnitude of a great steam railroad system, like the Chicago & Northwestern, for example, covering an empire with its lines and serving the populations of half a dozen states, directly, to say nothing of the through business from ocean to ocean, says the Chicago *Daily News*. But perhaps the magnitude of the business of transporting passengers, conducted by the street and elevated railroads of Chicago, is not so well understood.

A report to the civic federation, recently made, shows that these local companies have a total length of 1,020 miles—which would make a pretty respectable trunk line. While no reports are made of the operations of the smaller companies, the three big surface roads and the three elevated roads earned, gross, nearly $14,000,000 last year. It may very safely be said, therefore, that all the local street and elevated roads collected in that year 300,000,000 fares, which is equal to saying that every man, woman and child in the city paid a five-cent fare 150 times during the year, or, roughly, every other day.

This, like everything else in Chicago, has been a matter of growth, and it is only in recent years that travel has reached anything like this proportion. Still, the report in question shows that, in the last 10 years, the three principal surface companies—the City Railway, the North Chicago and the West Chicago—earned, gross, over $100,000,000—practically all in five-cent pieces. This is equal to 2,000,000,000 fares; that is to say, these three companies, in 10 years, have moved the whole present population of the United States about 270 times.

A New Magneto Bell.

The illustrations herewith show a new design of magneto bell, manufactured by the Williams Electric Company, Cleveland, Ohio. It will be remembered that Mr. Williams has been designing and manufacturing magneto bells in an extensive way for several years.

Fig. 1 shows a front view of the generator. The magnets are held to the pole-pieces by brass bolts, and the arrangement is such that there is no space between the central and the outer magnets, so as to utilize all of the space on the pole-pieces radially adjacent to the armature. The magnetic field is composed of three powerful horseshoe magnets, which are three-eighths of an inch in thickness and one and one-quarter inches in width, and are highly polished and nickel-plated. There is also a very perfect and ingenious method of taking the magnetism from the permanent magnets and distributing it uniformly around the cylindrical surface of the pole-pieces by means of contact plates, illustrated in Fig. 2. Each contact plate has two ears turned inwardly to hold the plate in its position on the pole-piece, and has, also, four ears turned outwardly to hold the permanent magnets rigidly in their proper position on the generator.

Three portions of this contact plate are left flat or straight, so as to make a good contact surface on the permanent magnets, and two portions are formed so as to make curves coincident with the outside curvature of the pole-pieces. This arrangement not only gives perfect contact between the permanent magnets and the pole-pieces, but also takes the magnetism from the permanent magnets, at or about a horizontal line bisecting the armature circle. The advantage thus gained is that, instead of short circuiting the permanent magnets, by allowing the pole-pieces to make contact at a higher point, a considerable longer length of permanent magnetism is utilized to drive the magnetism through the armature, instead of being given up entirely to the one purpose of making contacts. In this way, it is claimed, a better contact is obtained than in the old way, and at the same time a greater effective length of permanent magnets.

The end plates which hold the shaft bearings are punched from heavy brass, and have riveted into them very long brass bearings, which is an important feature towards making the machine run quietly for a long

period of time. These end plates are practically self-centering, so that the armature can be shifted and held centrally in the curvature of the pole-pieces, so as to prevent the armature wings from striking. This feature is important when making repairs on the generator, for one is enabled to take this machine apart and repair the winding and reassemble it without the use of any special tools or appliances, and with but little trouble. This machine is equipped with a very reliable clutch form of automatic shunt or cut-out, which by reason of its simplicity of construction is not liable to get out of order.

The driving-gear, which, it is stated, embodies a new principle in gearing, is of novel construction, and is placed on the left-hand side of the generator, so as to avoid unequal wear on the gear bearings caused by turning the crank. This feature obviates the disagreeable noise caused by the unequal wear of the gear bearings due to operating the crank. With this construction the proper center distance between the gear shaft is maintained indefinitely.

The gear is made from a brass punching, which is radially corrugated, the object of which is to provide a driving-gear that will distribute its tooth surface over the tooth surface of the pinion in a uniform manner, doing away with noise and giving long life. This gear, it is asserted, will not only last longer, but will run quieter during its life than will a wide-face, cast cut gear, for the following reasons: Owing to the exact equality of the tooth surface of both the gear and pinion, the wear on each of them will be precisely the same, in spite of the difference in their diametrical sizes, as will be seen from the illustration. This novel feature produces an exactly uniform rate of wear on all the surface of all of the teeth on both the gear and pinion. The effect of wearing at the same rate will maintain to a greater extent the proper curves of the teeth, of both the generator and pinion, causing them to roll one upon the other, instead of sliding and grating.

The pinion is attached to the armature shaft by means of a key and machine screw, and can be instantly taken off and replaced without having to be driven off or on. This little feature is of great convenience when repairs are necessary. In fact, the object of the designers of this instrument seems to have been to construct a magneto bell that would last indefinitely, with but few repairs, and so constructed that all necessary repairs can be made with the slightest possible loss of time or cost of material.

The resulting wave of current of this generator, due to the peculiar construction of the pole-pieces, approaches very closely the sinusoidal form, which form of wave is very

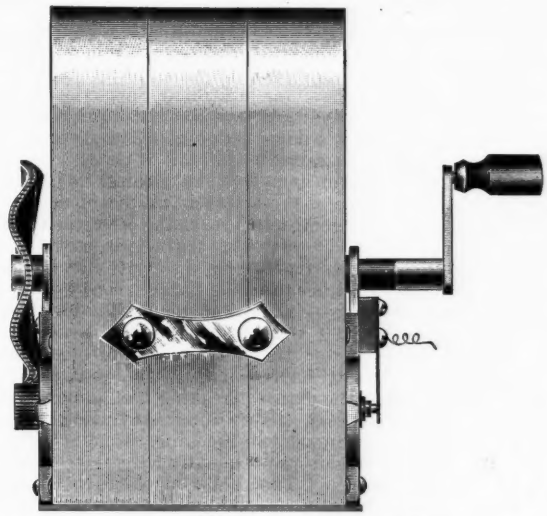

FIG. 1.—GENERATOR OF NEW MAGNETO BELL.

useful in transmitting signals over long, leaky lines, having a high coefficient of self-induction or static capacity, thus making this instrument ideal for toll-line work.

The ringer, as will be seen from the illustration, is a new departure, having but a single core, which is parallel with the vibrating armature. The core heads or end pieces are formed of Swedish iron, and are swaged onto the core under an enormous pressure which practically welds the end pieces to the core,

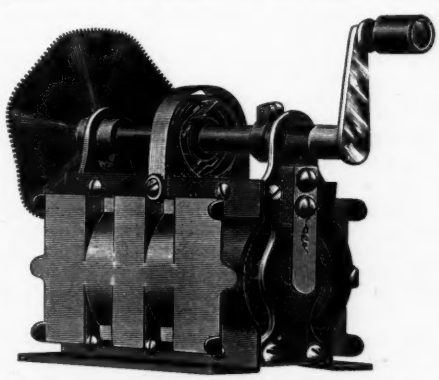

FIG 2.—SHUNT AND CONTACT-PIECES OF NEW MAGNETO BELL.

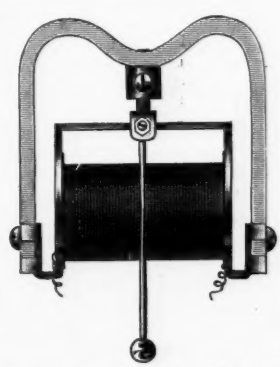

FIG. 3.—RINGER OF NEW MAGNETO BELL.

forming a very perfect magnetic joint. There are no screws used to secure the core, therefore no possibility of deterioration of the electro-magnetic circuit, due to effects of rusty joints and loose screws. The permanent magnet of the ringer is of the consequent pole type, which has the armature suspended from the central and consequent pole.

It strikes a very hard and stiff blow to the gongs, and in perfect unison with the generator pulsations, irrespective of the speed of the generator. This is a valuable feature in toll-line signaling, where sharp, clear and distinct signals are almost an absolute necessity. The core being situated longitudinally between the end poles of the permanent magnet, is constantly subjected to a magnetic stress, which accounts for the delicate responsiveness of this ringer to extremely weak currents, on the same well known principle under which an ordinary telephone receiver operates, as there is already a magnetic field existing in the core of the ringer. In operating this ringer, it is not necessary to swing the core, and with it the balance of the electro-magnetic circuit through so long a cycle, as in the usual type of ringer.

The bell has a long lever gravity switch hook, with Craig silver contact-pieces firmly attached to a hard-rubber block, which, together with the hook, is mounted in the bell-box in such a way as to make the switch hook entirely self-contained, the advantage of which is obvious.

The cabinet work is wired throughout with tinned copper wire, which rests between tinned spring washers, secured by screws entering the binding posts, thus forming spring contacts. All other contacts are soldered. This valuable feature should save any trouble due to loose contacts.

The receiver cord-binding posts which are located on the lower left-hand corner of the base of the instrument are unique and are formed in such a way as to make a lock for the receiver cord tip that will hold it like a vise, and at the same time hold it in position with a firm but spring pressure which will prevent it from working loose and dropping out of the binding-post.

In the design of this bell the manufacturers state that every point in the construction of magneto bells has been carefully considered, and every defect developed in existing forms has been studiously avoided and ingeniously remedied. These machines are wound with the best quality of insulated copper wire, to ring through any specified resistance, from the standard of 10,000 ohms up to 150,000 ohms. This company is also designing a bridging bell system that they will shortly have ready for the market, which it is claimed will be clear from all possibility of infringement of the Carty patent, being at the same time fully as efficient.

Fire and Police Telegraph Superintendents.

As already announced in the ELECTRICAL REVIEW, the third annual convention of the Association of Fire and Police Telegraph Superintendents and Municipal Electricians will be held at Elmira, N. Y., on August 9 and 10. Headquarters will be at the Hotel Langwell.

Papers touching on electrical matters, cause and effect, construction, maintenance, etc., will be read by the following well known electricians: Capt. William Brophy, chief electrician, Boston; S. L. Wheeler, city electrician, Springfield; John W. Aydon, superintendent fire and police telegraph, Wilmington; F. P. Foster, superintendent of fire telegraph, Corning; M. W. Mead, city electrician, Pittsburgh, and others, to be followed by open discussion.

An attractive entertainment programme has been arranged, including a trip to Watkins Glen on August 11.

THE HENRY REGENERATIVE CONTROLLER FOR ELECTRIC CARS.

BY JOHN C. HENRY.

During the past year the writer has been engaged in the development of a new method of control for electric cars, which is named "the regenerative system," a briet description of which was published in the principal electrical papers last Summer.

The system consists mainly of a combination of the features of the series multiple control, electric brake and independently excited motors. After making hundreds of tests, the great majority of which were failures, we have succeeded in producing a street car controller which has the following surprising advantages over the best of those in common use:

1. For all practical purposes we are able to increase the capacity of the present standard forms of motors about 25 per cent.

2. In ordinary electric railway service an increased efficiency of 40 per cent is within reach over the present methods.

3. Much quicker acceleration is available than is possible with the ordinary railway motors.

4. An ideal breaking system is provided without friction or wear of parts.

5. Without regulation the cars may make the same speed in the suburbs, where the voltage is low, as they do in the vicinity of the power station, thus avoiding the necessity for boosters.

6. Arranging so that the cars run (without regulation) on the up or down grades at about the same speed as they do on the level.

7. Arranging so that the motors are electrically tied together, thus preventing one of them from racing when they are connected in series.

8. Reducing the output of the station and, consequently, the losses on the feeders and rails.

9. Protecting the motor from injurious induced currents.

10. Arranging so that the torque or the ability of the motors to start or pull a very heavy load may be temporarily greatly increased without an injurious current in the armature.

11. Providing a breaking system which can not flatten the wheels.

For traction purposes an independently excited motor has about 25 per cent greater capacity than a series motor of the same size and cost. To explain, it is well known the capacity of any form of motor is limited only by its ability to withstand heat. It is also well known that the heating effect in the conductors is proportional to the density of the currents. It is also well known that in order to secure light weight, compactness, etc., the efficiency of railway motors is not high when they are working hard or when they are overloaded. The field magnets absorb about 25 per cent of the energy. Theoretically they should absorb none. The best dynamcs do not require over one per cent of their energy in magnetizing their fields, and the earliest dynamos and motors made used permanent magnets for fields, which required no expenditure of energy. What is needed is a magnetic abutment. It is not essential whether it be in the form of temporary or permanent magnets, providing it is strong and compact enough.

Now, by way of illustration, say, to do a certain work, the motor (either the series or independently excited kind) requires 100 amperes at 500 volts pressure. In the series motor the armature and fields would heat badly because they have to carry the entire current, while in the other case, the armature would have to accommodate but 75 amperes, while the fields provide a path for the balance. The heating effect is consequently decreased 25 per cent just at the desired time.

Our claims to improved efficacy will be readily appreciated in considering the following points: Tests made on the principal street and elevated railways in the country show that about 600 per cent of the total energy used by the cars is absorbed in getting them under headway. The most popular controllers now in use have eight running positions, six of which waste energy by passing the entire current through dead resistance. With our controller we use no resistance in the armature circuits. Our regulation is done by the smaller member; i. e., the fields which ordinarily handle but about 10 per cent of the current, and at no time over 25 per cent of it. It must be clear to those who are familiar with the many tests made comparing the economy of the series multiple and rheostat methods of controlling motors that we effect a great saving in that way. The other principal saving comes in by recouping current to the line. It takes nearly as much power to stop a car as it does to start it. In stopping, our motors automatically become dynamos and generate a current to the line, thus relieving the station, dynamos, feeders, etc. The stored-up energy of the momentum in the cars or the force of gravity on descending grades being turned back into the line in the form of current. This is illustrated in a pretty way by placing a wattmeter in the motor circuit. Turning the controller handle on, makes the disk revolve in one direction, showing it to be driven by current from the line, while turning it off reverses the direction of the disk, showing the current to be going back into the line from the motors. So sensitive is the wattmeter and this method of regulating motors that the disk will frequently change directions while running on level track without changing the controller, this action being caused by slight fluctuations in the line voltage.

High speed of the car is automatically maintained in the suburbs, where the voltage is low. The explanation to this is the strength of the fields is controlled by the line voltage. When it is low the weaker fields allow the armatures to take more current, and, consequently, they tend to run faster, but with less torque. In consequence of these oppositional influences, the speed of the car remains about the same as when it is near the power station.

The greatest advantage of the system is in the ideal way in which it breaks the car without friction, avoiding flat wheels, etc. By simply turning the controller handle backwards the car is readily stopped, smoother even than with the air-brake, or it is retarded on descending grades and any desired speed maintained by regulating the controller handle. The breaking is all done by the armatures, without any additional mechanism. Breaking through the gears has frequently been referred to as objectionable, but such conclusions have certainly been reached without proper consideration. The breaking of motor cars by hand brakes brings about as much strain on the gearing as when it is done by the armatures. If the reader has any doubt about this point, let him examine the gearing from a single-ender car, and he will find the teeth are worn just as much on one side as on the other. That has been the writer's observation, and we have examined hundreds of them.

On many roads rapid acceleration is desired. This is within easy reach with our form of control, and may be obtained in a much more economical way than is possible with series motors. In series motors heavy currents are necessary to speed up the armatures quickly, while these same heavy currents must pass through the fields which strengthen its magnetization and in turn tend to retard the armatures. Rapid acceleration with series motors is only obtained with abnormal currents in the armature and using the same currents in the fields, which are generally saturated with the more moderate currents. Consequently, the excess current does not check the armature, but its wasted energy is absorbed in heating the fields, increasing their resistance, which, in effect, is the same as if idle resistance was inserted in the main current.

In the regenerative system each member is supplied with currents independently, so that the requirements for torque or speed may be met directly without waste. In the series motor the field magnets are not self-protected, while in the regenerative system the fields protect themselves automatically; that is, their current supply is controlled solely by their resistance. If they heat, their resistance is increased and the current reduced.

While the same theory applies in series motors, with them it has but a small fraction of the force, as in the former the voltage across the fields is the maximum from the line, while in the series motor, in excessive cases, it would not be over one-quarter of this.

The most frequent cause of injury to motors is the "back kick," which occurs when the circuit is broken. This is generally the cause of grounding motors. The pressure of this induced current, which is higher than that from the line, depends mainly on the rapidity of the break and on the number of convolutions on the field coils. Principally for this reason, shunt wound motors have not been used for traction purposes. There are two ways to avoid this danger. The first, to wind the magnets with heavy wire, which is not practicable. The second, to provide a better path for this discharge than through the insulation. The pressure of this induced current is proportional to the resistance it encounters; in other words, it could not kick without resistance to kick against. If we short-circuit the fields there is no kick because there is no resistance. If, instead, we place them in parallel with the low resistance armatures the kick is insufficient. If, however, we break the field circuit at a time when the armature circuit is also broken, the resistance then is high, and the force of the kick corresponds. It must dissipate in the air with a great flash or finds its way to the ground by piercing the insulation. To avoid this flash and to protect our fields from this intense piercing stress, we place a non-inductive resistance of small carrying capacity within the controller, and arrange so that it is connected in parallel with the fields whenever the armature circuit is opened independent of the fields. This same resistance may be used in special cases to protect the motors from lightning by using a supplementary switch.

When running with the motor in series with the regenerative system, the adhesion is greatly improved. The motors may be connected together, so that any tendency of one of them to race is instantly and automatically checked by its current supply being decreased and that of its mate increased. In the ordinary method of connecting motors the reverse is the case; that is, the slipping of the driving wheels of one motor decreases the torque of the other. In the early days of the electric railway this objection seemed to be so serious that the practice of running motors in series was tabooed. To-day the strongest electric locomotives are built unnecessarily heavy to improve the adhesion. In the regenerative system the same results may be obtained by a cross connection centrally between the fields and armature.

The series multiple method of controlling motors looks very simple, but it was canvassed over a long time before its success was assured. To change a pair of motors, which are using a heavy current, from 250-volt to 500-volt machines in a fraction of a second without injurious arcing of the current, or mechanical strains on

the machine and car, is the requirement. It was met first by Mr. Potter in a unique way; that is, by short-circuiting one of the motors. In doing this the motor starts to act as a dynamo, and generates just sufficient current to counteract the residual magnetism in the magnets, which, if it were allowed to remain, would be sufficient to cause a tremendous current to be generated in the armatures. In changing the armatures in the regenerative system from series to parallel, this same method could not be employed.

Instead, we short-circuit one of the armatures with resistance, leaving the fields excited. The resistance is predetermined and arranged so that the armature, although revolving under strong fields, has its tendency to generate in the short circuit. Counteracted by the line currents, which attempt to drive it as a motor, these neutralizing forces permit the armature circuit to be broken without any flashing. Another method of changing the armature from series to parallel is to break the circuit when the fields are weak and connect them in parallel under the fields when their strength has been doubled.

In the regenerative system the reversing is done by the fields instead of the armature. Provision may be made within the reverse switch, whereby putting the reverse handle in a second notch connects the fields from series to parallel, thus providing for great torque or breaking force. This is operative only while the motorman has the reverse handle in the second position and is intended for use in emergencies only, such as starting heavy loads, pushing disabled cars up short, heavy grades, or for emergency braking stops to prevent accidents.

Ordinarily our fields are wound so they would stand the full line potential all day without injury to the insulation. They consequently are much more reliable than those of series motors. The armatures when doing the same work carry 25 per cent less current than if they were working as series machines. They are not exposed to the high induced current ordinarily projected by the field magnets when the circuit is broken in series machines, which is the common cause of disabling armatures, and they consequently will be more reliable. We are no longer concerned in any question of the controller's ability to do all we have outlined in the preceding claims. The question of its ability to stand abuse is the only remaining one. Whether it is better to depend on educating the motorneer to regulate the controller with care, or to protect it with additional mechanism to prevent its abuse, seems to be the only remaining question.

With the regenerative system the car must be accelerated by moving the controller handle slowly instead of depending on the gradual automatic reduction of the field strength as in series motors. It is also very important that the controller be turned off slowly, because when the handle is back in the starting position the car is at a stand. A quick sweep of the handle backward would make a stop too sudden for the passengers. It would send a tremendous current back into the line, which would be liable to arc over at the motor's brushes and blow the fuse.

In the regenerative system arc extinguishing devices such as magnetic blowers, etc., are not necessary; owing to the small number of turns on the armature the self-induction and arc formed on breaking its circuit is very small as compared with that of series-wound machines.

Another reason is explained as follows: When running with any form of motor the back pressure is nearly the same as that from the line; say on a railway circuit it is 480 volts where the line voltage is 500. (Now, if these pressures were equal there would be no current flowing in either direction.) If we break the armature circuit where the motors are in series, the back pressure decreases as the fields are weakened by drawing out the arc, so that at the time the arc is ruptured there is a difference of 500 volts potential between the contact points. In the regenerative system we break the armature circuit and maintain the fields at full strength, so that the back pressure is not reduced, and the difference of potential between the points of contact is but about 20 volts, as compared with 500 with the series motors.

When a reliable breaking system is arranged for within the controller, it leaves an opportunity for desirable improvements in car construction. The controller instead of occupying an unstable position at the car dash, where it is exposed to the storms, may be placed with its back against the end of the car body under one of the windows between the steps and the car door. In this position, by using a specially arranged handle, the car may be operated from a position at the car door, either from the in or outside, thus avoiding the necessity for vestibules, which are a necessity at some times, but generally a dangerous nuisance. This location is preferable, as the wires may be carried mainly under the car seats instead of exposing them underneath the car floor.

The Electrolytic Gold Man Goes to Europe.

A press dispatch from Boston, under date of July 26, conveys the following interesting information:

The Electrolytic Marine Salts Company has stopped the issue of stock pending further investigation, as the inventor of the process, the Rev. P. F. Jernegan, is believed to have sailed for Europe on Saturday without notice to his associates.

The usual $2,000 gold and silver brick arrived yesterday from North Lubec. The company has collected about $1,000,000 and paid to Mr. Jernegan $338,378.40. Those connected with the Boston office of the company have honorable reputations, and will spare no efforts to ascertain if there has been deception.

American Impulse Wheel Company's Water-Wheels.

The American Impulse Wheel Company, of New York, states that it is making steady headway with its improved water-wheel, and that it is attracting considerable attention in this and foreign countries. The company reports that it has the most satisfactory commendations in every instance, and finds business increasing rapidly.

Besides wheels shipped to various parts of the United States, and reported giving most favorable results, the company has wheels installed in Japan, France, Sweden and Scotland. Among contemplated large power and transmission plants in Utah, Canada, Montana and Minnesota, this company's wheels are being given serious consideration; and the company confidently expects the adoption in several instances as per advices now in hand. The Columbus, Ohio, plant, which this company is building, will be a novel one.

The company informs the ELECTRICAL REVIEW that it has all the advantages in its water-wheel of the best heretofore in the market, with added improvement as the result of the latest scientific knowledge and test. They claim to spare no pains to perfect mechanical design and construction, together with the highest efficiency, and give special attention to regulation. Mr. Thorburn Reid is consulting engineer of the company.

ELECTRIC RAILWAY NOTES.

The Southern Electric Railway Company, of St. Louis, is erecting a new $30,000 office building, and is also making extensive improvements in its power plant which will cost $130,000.

The report of the United Traction Company, of Pittsburgh, shows:

Month of June.	1898.	1897.	Increase.
Gross	$132,321	$125,302	$7,019
Net	73,300	43,389	29,811
Charges	51,523		
Surplus	21,686		

The directors of the Kinderhook & Hudson, N. Y., Railway Company at their annual meeting elected the following officers: President, James Purcell; vice president, Frank H. Stott; secretary, J. Spencer Hosford; treasurer, Charles W. Bostwick.

At the annual meeting of the Glens Falls, N. Y., Sandy Hill & Fort Edward Street Railroad Company the following were elected directors: Jonathan M. Coolidge, Frederick F. Pruyn, Howard H. Pruyn, Samuel Pruyn, Harmon R Leavens, Byron B. Fowler, Joseph Fowler, Louis M. Brown, Grenville M. Ingalsbe, Daniel S. Griffin, A. P. Hill, Edward N. Sanderson, Loren Allen; inspectors of election, Royal J. Eddy, John B. De Long. The following officers were subsequently elected: President, Jonathan M. Coolidge; vice-president, Loren Allen; secretary and treasurer, Fred Pruyn; executive committee, Mr. Coolidge. Byron B. Fowler and Howard H. Pruyn; auditing committee, A. P. Hill and Daniel S. Griffin.

The official statement of the Union Traction Company, Philadelphia, for the year ended June 30, 1898, shows:

	1898.	1897.	Increase.
Receipts from all sources	$10,971,437	$10,480,645	$490,791
Operation	4,456,375	4,949,850	*493,475
Net receipts	$6 515,062	$5,530,795	$984,266
Fixed charges and taxes	6,490,441	6,382,730	107,711
Surplus			24,630
Deficit 1897			851,934
Increase, as compared with 1897			876,555

*Decrease.

The first 17 days of July, 1898, show an increase of gross receipts, as compared with the same days of last year, of $45,570.15.

LITERARY.

Short stories by Rudyard Kipling, Rowland E. Robinson, William Allen White, Cutcliffe Hyne, and several others, make *McClure's Magazine* for August especially a fiction number. In Mr. Kipling's story we have a new and most diverting chapter in the lives of those most ingenious and audacious English school-boys—Stalky, Beetle and McTurk. In Mr. White's we have an account of the first real passion of our old friend, the King of Boyville, Winfield Hancock Pennington—familiarly known as "Piggy." The other stories are no less characteristic of their authors; and all are interesting, cheerful and wholesome, affording a diversion that is both nutritious and palatable.

The fiction number of *Scribner's Magazine* has been an institution for a decade. In it have appeared many notable short stories that have made their authors famous. It has also been the occasion for several novel and successful experiments in color-printing. This year the colored cover is one of the four prize designs by Albert Herter, and it is a brilliant example of decorative printing. The most ambitious scheme in color-printing undertaken by an American magazine is the reproduction of eight full-page designs by Henry McCarter, which accompany E. S Martin's noble poem, "The Sea is His." The way in which the shading of color is attained is mechanically ingenious and artistically effective. It is a novelty in color-printing, even for experts.

ADVANCE INFORMATION

New Telephone and Telegraph Companies.

KNOXVILLE, TENN.—The People's Telephone Company is gradually extending its lines toward Chattanooga, and it is thought the company will eventually establish an exchange there.

CLAYTON, ILL. — Siloam Springs Telephone Company has been incorporated; capital stock, $1,500; incorporators, G. L. Thomson, John Padgett and John W. Butz.

HOUSTON, TEX —The Postal Telegraph Company has completed its line to this place, and now has connection with every important point in the Lone Star State.

LAKE BENTON, MINN.—The long-distance telephone company has completed its line to this place.

FAIRMONT, W. VA.—The Rivesville & Montana Telephone Company has been incorporated by C. E. Gaskill, J. C. Gaskill, F. B Clayton, J. P. Coogle and others, to construct and operate a telephone from Fairmont to Rivesville; capital stock $50,000.

SPARTANSBURG, S C.—The Home Telephone Company has applied for charter and for privilege to construct telephone system in the city.

DURHAM. N. C.—C. Egan, of Connecticut, contemplates the establishment of a telephone factory in Durham, to be operated in connection with the Interstate Telephone.

DENISON, TEX.—It is proposed to construct a line of telephones from Denison to Tishomingo.

FLORENCE, S.C.—R. C. Commander is president of a company which has been organized to conduct telephone lines.

MAGNOLIA, MISS.—T. B. Lampton can give information concerning establishment of telephone system.

CAWKER CITY, KAS.—The business men of this place have organized a long-distance telephone company and will soon have one in operation.

SAGINAW, MICH.—The Owosso Telephone Company is now connected with St. Johns, Lansing and South Chicago, and will soon be connected with Grand Rapids.

ST. THOMAS, ONT.—The People's Telephone Company, Limited, with a capital stock of $60,000, has been incorporated; directors, A. E. Wallace, E. A. Smith, F. M. Griffin, S. Chant.

WINONA, TENN.—The Cumberland Telephone and Telegraph Company have extended their toll lines as far south as this place, having equipped all the stations on the Y. & M. V. R. R. with long-distance telephone and metallic lines.

PORTVILLE, N. Y.—The Bell Telephone Company is building a new line from this place to Bolivar.

THOMPSON'S LAKE, N. Y.—The Hudson River Telephone Company has completed its line from this place to Albany.

NILES, MICH.—Dowagiac capitalists will establish a new telephone system here to compete with the Bell company. The system will be first-class in every respect and will be connected with the independent long-distance line.

UPPER FALLS, MD —The Baltimore & Belair Telephone Company have asked permission of the County Commissioners to lay a telephone line from this place to Franklinville and thence to Jerusalem Mills.

DAYTON, TENN.—The East Tennessee Telephone Company will establish a long-distance station at Spring City. A loop will be run out to Rhea Springs and a station established there.

BENNETTSVILLE, S. C.—Mr. A. J. Matheson is building a telephone line from this place to his large plantation at Egypt, four miles west of town. This will connect all of his various plantations in this county and Marion by telephone wire.

JASPER, N. Y.—A telephone line is to be established between this place and Canisteo by a local company.

Electric Light and Power.

PECKVILLE, PA.—The contract for installing the electric light plant at this place has been awarded to the Scranton Electrical Construction Company for $12,837.

PHILADELPHIA, PA.—Doyle & Doak are taking bids for alterations to Station 5 building of the Pennsylvania Heat, Light and Power Company, on Callowhill street west of Twenty-fifth, and for the new fire house to be erected at Second and Quarry streets.

CHICAGO, ILL.—The new municipal electric lighting plant at Rice and Lincoln streets is now in operation. City Electrician Ellicott superintended the work of starting the new machinery. The station is equipped with large dynamos of the most modern design. The power is supplied from two batteries of boilers.

CLEVELAND, TENN.—A charter has been granted to the Cleveland Electric Light and Power Company. Incorporators, W. W. Cunningham, Frank Spurlock, Foster V. Brown, John C. Ramsey and C. A. Danals. The capital stock is $10,000.

ALBANY, N. Y.—Kinderhook Power and Light Company, of Rensselaer County, has been incorporated to furnish electricity for heating and lighting purposes in the cities and villages of Rensselaer County; capital, $50,000. Directors: James Purcell, of Valatie; James R. Hughes, Jas. Hogan and John Ritz, of Stuyvesant Falls, and William D. Barnes, of Brainerd.

LAFAYETTE, ALA.—Chas. Schurssler may be addressed concerning bids which are being invited for furnishing and constructing an electric light plant.

WILLIAMSPORT, MD.—M. Emmett Cullen, Town Treasurer, may give information concerning the construction of electric light plant, for which $20,000 worth of bonds will be issued.

DARLINGTON, N. C.—The Charlotte Electrical Engineering and Supply Company has been awarded contract, by the Darlington Manufacturing Company, for furnishing and putting in an electric light plant.

NATCHEZ, MISS. — The Natchez Light, Power and Transit Company has been incorporated by Maurice Mase and others; capital stock, $200,000.

SPARTANSBURG, S. C.—The Spartansburg Gas, Electric Light and Street Railway Company has been incorporated by William E. Lown, George G. Day and Albert Leszynsky; capital stock, $200,000.

NORFOLK, VA.—J. Q. Dickinson desires bids on electric light, hot and cold water, etc., for hotel.

New Electric Railways.

BETHLEHEM, PA.—It is probable that an electric road will be constructed between this place and Nazareth. The matter is now under consideration.

NEW YORK, N. Y.—The Metropolitan Street Railway Company has certified to the Secretary of State an extension of its line from the intersection of Sixty-fifth street and Columbus avenue, along said avenue to its intersection with the Boulevard.

SCHUYLKILL, PA.—The Schuylkill Electric Railway Company has leased the new Schuylkill Haven & Orwigsburg Road, and it will be formally opened in a few days. President, C. P. King; directors, F. H. Treat, Thomas P. Prosser, William F. North, W. C. Pollock and S. P. Ritter, all of Philadelphia, and R. C. Luther, of Pottsville, and others.

LOCKPORT, N. Y.—The trolley line between this place and Buffalo will be completed in a few days.

LOUISVILLE, KY.—The extension of the Madison Electric Car Line to Hanover is being agitated.

COLUMBUS, OHIO—The Dayton & Northern Electric Railroad Company has been incorporated to build an electric road from Dayton to Troy through Chambersburg, Vandalia and Tippecanoe. The incorporators are James Christy, H. E. Kimball, W. C. Sheppard, F. J. Sloat and A. E. E. Horren.

SOUTH BEND, IND.—The right of way for the new electric road from this place to Benton Harbor has been secured. John A. Russell, of Detroit, and a New York capitalist are furnishing the money. The water-power at Berrien Springs will be utilized to operate this road.

ATHENS, GA.—It is reported that the Athens Street Railway Company will extend their line two miles beyond the city limits to the power plant, where a park will be located.

CAMDEN, N. J.—A project for the construction of a trolley line between Camden and Atlantic City is on foot.

New Incorporations.

BALTIMORE, MD.—The Electric Amusement Company, for exhibiting theatrical and spectacular productions, has been incorporated by John Fay Palmer, of Cleveland, Ohio, and George F. Lurssen, Otto M. Mattfeldt, Arthur L. Herring and Herman H. Lurssen, of Baltimore. The capital stock is $10,000.

CAMDEN, N. J.—The Union Electric Company has been incorporated.

Business Troubles

MANSFIELD, OHIO—A receiver has been appointed for the Card Electric Company, which was organized in December, 1893, with a capital stock of $100,000. It manufactured car motors.

"Electrical Engineering" Changes Ownership.

As already announced in the ELECTRICAL REVIEW, the Chicago monthly, *Electrical Engineering*, has been sold by its former proprietor, Mr. Fred De Land. The new owner is Mr. Carl E. Kammeyer, until recently and for several years past the western representative of the ELECTRICAL REVIEW.

Mr. Kammeyer expects to publish the August number between the first and the eighth of the month. He outlines his policy as follows:

"My intention is to publish the paper as an independent, dignified electrical journal, whose principal object will be to champion the cause of the independent telephone interests, without resorting to the rabid and ultra-violent methods used by its former owner in behalf of the Bell company. There is not now, and will not be, any one interested in the paper who is in any way, financially or otherwise, interested in the manufacture of telephone apparatus or the operation of an exchange."

Mr. Kammeyer is a good newspaper man, and has had a great deal of practical electrical experience. In embarking in his new enterprise he has the best wishes of the ELECTRICAL REVIEW and, doubtless, of his many friends throughout the electrical field.

The Appellate Division of the Supreme Court in Brooklyn, N. Y., has reversed the verdict awarded to Mrs. Carrie E. Read for $29,966 82 against the Brooklyn Heights Railroad Company for the killing of her husband, contractor John J. Read, and has ordered a new trial. Justice Woodward, who writes the opinion, holds that the testimony given by one John O'Grady should not have been admitted for the consideration of the jury, especially as no regular partnership was known to exist between him and the deceased.

Electrical.... Patents.

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED JULY 26, 1898.

607,830 Device for operating electric switches; J. H. Cary, Springfield, Mass.—Consists of a source of electrical energy, suitable conductors, means for switching in a predetermined amount of electrical energy, one or more rotary electro-magnetic motors in the circuit, a switch-ring or equivalent device operated by the electro-magnetic motor and a supplementary or derived circuit, made or broken at will by the operation of the switch-ring.

607,918 Cross-over for trolley systems; C. E. Davis, Chicago, Ill.

607,919 Electric tramway; Alfredo Diatto, Turin, Italy—Consists of a vehicle, an electro-magnet having a yielding or flexible connection with the vehicle, a magnet-bar made flexible to adapt it to yield to irregularities in the tracks, and means for adjusting said magnet and bar relatively to the ground.

607,921 Electrical measuring instrument; Geo. K. Elphinstone, London, England—Consists of an electro-magnet core, the primary windings disposed thereon, the secondary winding, a pivoted or swinging coil mounted between the poles of the core, and included in closed circuit with said secondary winding, and an indicating device operated by the swinging coil.

607,992 Igniter for gas-engines; R. R. Hain, Grand Rapids, Mich.

607,994 Microphone; T. J. Howell, London, England.

607,997 Electrically self-propelling vehicle; L. Krieger, Paris, France—Consists of the steering wheels, an independent armature connected to each wheel, a fixed magnet in conjunction with each armature, a rheostat having independent electric connections to each armature, and a source of electrical energy, the field-magnet windings and the rheostat being connected in series with the source of electrical energy.

608,013 Reversing rheostat; I. E. Storey, Philadelphia, Pa.—In a motor-controller the combination of a rotary shaft carrying a crank disk, an abutment on the disk, a toggle lever bearing at one extremity against the abutment and pivoted at a fixed point at the other and a spring connected to the toggle joint.

608,015 Secondary battery; Georg Walter, Strasburg, Germany.

608,076 Electric telephone system for houses; Louis Plaut, New York.

608,104 Electric sounding device for ships; J. P. Buckley, New Orleans, La.—Consists of a suitable float and an alarm device, a shell or casing containing a liquid contact-maker, electric wires attached to the float, a casing, and an alarm device, to suspend the casing without giving an alarm, and to give an alarm when the casing is not suspended or partially so.

608,109 Electric light for surgical purposes; W. E. Dow, Braintree, Mass.—Consists of a head band, a reflector carried thereby, a condensing lens supported in front of said reflector, a lamp mounted between them, and means to adjust said lamp forward or backward relatively to the reflector.

608,132 Electro-static measuring instrument; J. F. Kelly, Pittsfield, Mass.—In an electro-static meter having fixed and movable vanes, a vane electrically connected to a conductor carrying electrical energy and embedded in a dielectric to prevent creeping of the charge.

608,133 Means for preventing stray magnetism in dynamo electric machines; J. F. Kelly, Pittsfield, Mass.

608,134 Electrical circuit controller; R. Lundell, New York, N. Y.—A circuit-breaker consisting of electro-magnetic means for interrupting an electric circuit, with means controlled by the movable part of the circuit-breaker and adapted to force or eject a blast of air around the circuit breaking contacts thereof.

608,135 Commutator brush-holder for dynamo-electric machines; R. Lundell—A brush-holder having adjacent brushes rigidly clamped against conducting pieces or blocks which permit them to abut against each other, said conducting blocks in turn being securely fastened to an arm or stud by means of flexible springs.

608,137 Electro-motor for electrically propelled vehicles; A. Siemens, London, England.

608,163 Bicycle lock; F. V. Walstrom, Chicago, Ill.

TRADE NOTES.

The Central Electric Company, of Chicago, reports a brisk trade on lightning arresters, and is issuing some very attractive circulars on the Wurts arrester, as well as the Garton arrester.

Almost the whole of Milwaukee is kept cool by breezes furnished by Lundell fan-motors. Julius Andrae & Sons' Company, who are the Milwaukee selling agents, have succeeded in placing the Sprague goods in many of the largest local business houses, hotels and theaters, including the Alhambra theater, Palm Garden and Kroeger Brothers' large clothing establishment.

The Mutual Electric Company, the latest bidder for public favor, has opened offices at 1218–1219 Marquette Building, Chicago, where it will hereafter conduct a general electrical construction business, including residence, theater, hotel and factory wiring, the installation of isolated and central station power and lighting plants, and the construction of electric railroads.

The Bibber-White Company, of Boston, is very busy in its railway department at the present time. This enterprising company lately secured the contract for a 45-mile electric road from Albany to Middleburg, N. Y. As announced in this journal, this company recently purchased all the rights and interest of the American Electric Company, of Boston, manufacturers of burners and fittings. The Bibber-White Company will continue to manufacture this product, and the special favorites are the "Victor" and "New Era" burners.

Site suitable for Power-House or similar use to lease for long term of years. Ground 84x84, within one block of BROADWAY, NEW YORK. Fronting on three streets, more ground adjoining could be acquired. Is high and dry, permitting basement thirty feet deep. Basement could also run under sidewalks of all three fronts. Apply to

HAWLEY & HOOPS,
271 Mulberry Street, New York.

THE "Demary" Switch

has a locking device, making it impossible to open until full tension of spring is obtained; this prevents dragging and insures an absolutely instantaneous break. All parts interchangeable. Every switch guaranteed free from defects of work or material. Ask for photograph and prices.

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133 ERIE COUNTY BANK BUILDING,
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COOKMAN ELECTRIC CO., Baltimore, Md.

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MORGAN STEAMSHIP LINES: New York to New Orleans. New Orleans to Texas. " " " Florida. " " " Havana. " " " Central America.
HOUSTON & TEXAS CENTRAL R'Y., SAN ANTONIO AND ARANSAS PASS R'Y. CO., to Fishing and Hunting Grounds and all other points in Texas.
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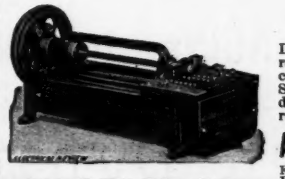
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